



**CATALOG
OF
AIR FORCE WEATHER
TECHNICAL DOCUMENTS
1941-2000**

SEPTEMBER 2000

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**UNITED STATES AIR FORCE
AIR FORCE WEATHER AGENCY**

Offutt Air Force Base NE 68113-4309

REVIEW AND APPROVAL STATEMENT

AFWTL/TC—00/001, *Catalog of Air Force Weather Documents 1941-2000*, September 2000, has been reviewed and distribution is approved for public release. Distribution is unlimited.

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September 2000

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PREFACE

This catalog supersedes AWS/TC—91/001, *Catalog of Air Weather Service Technical Documents, 1941-1991*, and USAFETAC/TC—95/001, *Catalog of Air Weather Service Technical Documents, 1992-1995*. It lists unclassified technical publications and other unclassified technical materials published or produced by and for Air Force Weather Agency, the former Headquarters AWS, Air Force Global Weather Center (AFGWC), Air Force Combat Climatology Center (AFCCC), and former AWS wings from about 1941 through 2000. Certain climatological summaries produced by the Naval Oceanography Command are included.

Programs for small calculators such as the TI-59 and HP-97 are obsolete and no longer available. The AFWTL maintains some of the code for these programs.

Nearly all the materials listed here are available from the AFWTL, the Defense Technical Information Center (DTIC), or the National Technical Information Service (NTIS), depending on the type of material and the requestor. Detailed availability information and ordering instructions are provided inside the catalog.

Listings for documents subject to "limited distribution" are indicated by the inclusion of their individual limited distribution statements and "export control" warnings, when applicable.

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Catalog of Air Force Weather Technical Documents

Chapter 1

INTRODUCTION

1.1 History of the Air Force Weather Agency (AFWA) Technical Publication System. The organization for weather in the Army Air Force's (AAF) headquarters during World War II was not the typical AAF staff section. A large part of its efforts were directed toward doing research, compiling climatological data, and preparing translations of foreign meteorological data. As a result, thousands of technical documents were prepared. Some of these were formally numbered and cataloged, and many are still part of the active AFWA technical publication inventory. Others have been maintained as part of the Air Force Weather Technical Library's (AFWTL) historical holdings. Unfortunately, many of these documents have been lost.

A formal technical publications system began to evolve in the fall of 1945 when the AAF's Weather Service started issuing technical reports as "AAFWS TRs," using the then-current AAF system or base and serial numbers. When the AAF Weather Service became the Air Weather Service in 1946, the report designation was changed to "AWS TR." The report numbering system was also changed in 1946, and again in 1950. AWS technical reports were divorced from the USAF standard publications system in 1961 to become a separate entity under Department of Defense preparation and publication rules. In mid-1973, there was another numbering system change, with the last two digits of the publication year added to the report number (e.g., "AWS-TR-73-251"). In 1979, formats were changed again to conform to the American National Standard and provide for serial numbering within each calendar year; e.g., "AWS/TR-85/001." The designators for technical publications changed from "AWS" to "AFWA" when the reorganization occurred in 1997.

The first AWS technical notes (TNs) were published in 1978, but USAFETAC had started issuing them 10 years earlier. Although several "bibliographies" of AWS technical documents were published in the 30-year period following World War II, the first "technical index" (TI) was not issued until 1979. The "index" became a "catalog" in 1985. In July 1985, a detached appendix (TCA) that listed all AFWA technical publications bearing distribution limitation statements "B" through

"X" was added. But since the reasons for maintaining a separate appendix no longer existed in 1988, the appendix (TCA) and its parent (TC) were merged with the April 1989 edition. Documents subject to "limited" distribution are so annotated in this catalog. Users of the catalog are cautioned to note and observe those limitations carefully.

1.2 How to Order from the Catalog. Detailed availability information, office of primary responsibility (OPR), and specific ordering instructions are given at the beginning of each catalog section. Some materials are available only in microfiche and others are available only in low quality microfiche paper copies. Still others may not be available for use outside the AFWTL; in these cases, at least some of the information required can be extracted and provided to qualified requesters by phone, message, or letter. General ordering instructions follow:

- Air Force units (including Air National Guard, Air Force Reserve, and AFIT) order from the AFWTL, 151 Patton Ave Room 120, Asheville NC 28801. Order by technical report number and title via the AFCCC website: www.afccc.af.mil. Note: AFWTL plans to convert most of the paper copies of technical documents into electronic copies. Approximately 200 of these documents have all ready been converted. Contact AFWTL for information concerning electronic documents.

- Other Department of Defense (DoD) agencies and bona fide DoD contractors order materials that have been archived at the Defense Technical Information Center (DTIC) by DTIC accession number (AD or ADI) from: DTIC, Cameron Station, Alexandria VA 22314. For materials without AD/ATI numbers, contact the AFWA OPR (office of primary responsibility) given in individual catalog sections. Documents with ATI numbers cannot be computer-requested and must be ordered from DTIC by mail or phone. Non-DoD agencies may request certain materials that have been archived from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield VA 22161, telephone (703) 487-4650.

1.3 DTIC/NTIS Cataloging and Numbering System.

AFWA technical publications are registered with DTIC and entered into the DTIC database to facilitate technical data exchange within the Department of Defense. DTIC registry allows any DoD researcher access to documents registered there. Certain AFWA technical publications (those designated as "approved for public release; distribution unlimited") are forwarded by DTIC to the National Technical Information Service (NTIS), where they are assigned another number and made accessible to non-DoD researchers.

1.4 List of Miscellaneous Catalogs and Indices.

- **AWS/TI-79/001** (AD-A177777) Index of AWS Technical Seminars, June 1979. Originally published as USAFETAC/TN-78/001. Lists technical seminars prepared by HQ AWS and other AWS units and reported as of 1 February 1979 in accordance with AWSR 80-3, Technique Development. Seminars listed may or may not still be available from the issuing unit.
- **AWS/TI-79/002** (AD-760091) Catalogue of Local Forecast Studies, July 1979. Formerly AWS Pamphlet

0-13, January 1973; republished as AWS/TI-79/002 without change. Note that this document lists only those forecast studies that had been prepared before publication of this document; the requirement for collecting and publishing such lists was subsequently dropped. With few exceptions, the documents listed here are available from the AFWTL, 151 Patton Ave Room 120 Asheville NC 28801.

- **7WW/TI-89/001** (AD-None) Index of Films, Briefings, and Other Training Aids Available for Loan, 15 November 1989. Supersedes 7WW/TI-87/001, July 1987.
- **7WW/TI-89/002** (AD-None) Technical Information Available for Mobility, 21 October 1989. Supersedes 7WW/TI-87/001, August 1987.
- **7WW/TI-89/003** (AD-None) Quick Reference Retention Index for AWS Technical Reports & Technical Notes and AFGWC, USAFETAC Technical Notes, October 1989. Supersedes 7WW/TI-87/003, 15 August 1987.

Catalog of Air Force Weather Technical Documents

Chapter 2

AIR FORCE WEATHER TECHNICAL REPORTS

The office of primary responsibility (OPR) for AWS/AFWA Technical Reports (TRs) is AFWA/DNT, 106 Peacekeeper Dr. 2N3, Offutt AFB NE 68113-4039. The documents themselves, however, are published, stocked, maintained, and distributed by the Air Force Weather Technical Library (AFWTL)—see Section 1 for general ordering instructions.

Some of the AWS and AAFWS technical reports listed here (identified as “AD-NONE”) are no longer registered at, or available from, the Defense Technical Information Center (DTIC). These reports have, at some time in the past, been “rescinded” by AFW officials, either because they were thought to have outlived their operational usefulness or because they no longer reflected AFW views. Such reports are included in this catalog and archived in the AFWTL primarily because of their historical value. Despite the fact that they may be technically obsolete, these documents contain irreplaceable information and background on AFW programs, systems, and techniques. They also show the chronological growth and development of AFW’s scientific and technical programs. Note that some technical report numbers are duplicated, a situation that resulted when officials “rescinded” a report, then reused the number.

Most documents listed here are available from the AFWTL in paper. Some of the earlier documents are held in only one library copy, or in microfiche reproductions. Check with the AFWTL; although some documents are in poor condition and marginally reproducible, copies will be attempted on request. Documents with a “#” symbol are known to have existed, but cannot be found. If you can provide copies of these, please notify the AFWTL at DSN 673-9019.

AWS TR 45-1 (AD-NONE) *Analysis of the Japanese Weather Service*, May 1946, 505pp. Redesignated and archived as AWS TR 200-1. A detailed analysis and description of the Japanese Weather Service as it was organized and operated during and before WWII. Describes Japanese weather equipment, forecasting and analysis techniques, climatology, oceanography, and more. One copy (bound) archived at AFWTL.

AAFWS TR 55-1 (AD-NONE) *The Weather Utility of Radio Set AN/APQ-13*, February 1946, 17pp. A report on field testing of the AN/APQ-13 Radio Set modified for use as a storm detection radar at seven bases in the southwestern United States during 1945. On the basis of APQ-13 performance during this test, AWS began expanding its storm detection network.

AAFWS TR 55-2 (AD-NONE) *Preliminary Instructions for Storm Detection Ground Installation of AN/APQ-13A*, February 1946, 22pp. Provides instructions for siting and installing this early storm detection radar set. Includes photos, wiring diagrams, start-up, tuning, and shutdown instructions.

AWS TR 55-3 (AD-NONE) *Determination of Absolute Height and Wind for Aircraft Operations*, Weather Division, Hq AAF, September 1944, 100pp. A primer

for altimetry. Gives theoretical basis and procedures for various altimetry methods vital to bombing and navigation. Addresses the hydrostatic equation, height determination and forecasting, pressure and radio altimeters, wind and drift determination, true height determination for high-level bombing. Describes and tells how to use aircraft weather instruments.

AWS TR 55-4 (ATI-74431) *Use of the Radio Altimeter in Determining Wind and Drift While In-Flight*, Weather Information Branch, Hq AAF, December 1943, 12pp. Gives theory and method for using radio altimeter to determine wind direction and speed, and therefore, drift. Derived from September 1943 note by J.C. Bellamy of the University of Chicago.

AAFWS TR 56-1 (AD-NONE) See AWSTR 55-3.

AAFWS TR 58-1 (AD-NONE) See AWSTR 55-4.

AWS TR 101-1 (AD-NONE) *Weather Forecasting for Radar Operations*, March 1944, 61pp. An early primer on radar theory and operational application in forecasting. Section I: Radio-Physics Background; Section II, Forecasting the NR Curve; Section III, Preliminary Climatological Survey of NR Curve Characteristics.

AAFWs TR 335-5 (AD-NONE) *Weather Forecasting for Artillery Fire*, May 1944, 51pp. A guide for weather forecasters who support artillery firing. Acquaints forecasters with ballistics; discusses relationships between ballistics and meteorology.

AWS TR 900-5 (AD-NONE) *Lectures on the Analysis of Variance and Covariance*, by Dr. A. Wald, March 1946, 145pp. In the absence of an adequate textbook on modern statistics, the AAF Weather Service received permission to print and distribute Professor Wald's Columbia University lecture notes on the subject. Report recommended for all those engaged in verification, development of forecasting rules and equations, testing of equipment or procedures, or any other activity employing statistical methods. Includes papers and notes on sequential analysis, a technique developed by Professor Wald.

AWS TR 900-10 (AD-NONE) *Notes on the Theory of Statistical Estimation and of Testing Hypotheses*, by Dr. A. Wald, March 1946, 137pp. Formerly AAFWSTR 200-2. A companion work to the above.

AWS TR 105-1 (ATI-72493) *The Structure of the Local Winds in the Los Angeles Basin, California*, Hq AAF Weather Service, September 1945, 30pp. Prepared by Former AAF Weather Research Station at University of California at Los Angeles under supervision of meteorology department staff as the partial result of a project for forecasting beginning and ending of sea breeze in Southern California and regions of similar climate. Although details are of practical value only to operations in the LA Basin, the general picture applies to local wind problems in other regions.

AWS TR 105-2 (AD-242199) *Wind Variability*, 10 March 1960, 91pp. Written by Maj. Hugh W. Ellsaesser, this report was designed to give weather forecasters methods for evaluating and applying wind variability data. Data is summarized in graphic and tabular form. Statistical methods for representing variability, data accuracy, and causes of variability are discussed. Past studies of the subject are reviewed. Appendix I tells how to use the data in the field; gives sample problems with solutions.

AWS TR 105-3 (ATI-65132) *On Vertical Motion in the Atmosphere*, Hq AWS, November 1945, 86pp. Contains three papers: (1) "Determination of the Field of Vertical Motion," by Robert G. Fleagle, Homer T. Mantis, and

H.A. Panofsky (surveys history of vertical motion studies, describes techniques for computation, and gives results of tests of these techniques); (2) "A Descriptive Study of the Field of Vertical Motion in a Colorado Low," by Robert G. Fleagle (a descriptive study of the three-dimensional field of motion in a cyclone); (3) "Computation of Vertical Motion from Constant Pressure Charts," by James E. Miller (describes a technique believed to be practical for use with constant pressure charts).

AWS TR 105-4 (ATI-82074) *A Study of Waves in the Easterlies*, prepared by the USAC Research Unit of the Ninth Weather Region, Rio Piedras, Puerto Rico (revised edition edited by H. Riehl, 1946), July 1945, 108pp. A published study of weather analysis and hurricane forecasting in the tropics. Study conducted by the Air Corps ITM Research unit attached to the Institute of Tropical Meteorology of the University of Chicago at the University of Puerto Rico, Rio Piedras, Puerto Rico. Discusses easterly wave formation, structure, weather distribution, maintenance, displacement, intensification, and termination.

AWS TR 105-5 (ATI-65136) *Tables of Equivalent Potential Temperature for the Standard Constant-Pressure Surfaces*, Air Weather Service, 1946, 8pp. Tables of potential temperature in °A for the surface of the earth. Equivalent potential temperatures are given for 1,000, 900, 850, 700, 500, and 300 mb surfaces. Condensation temperature given in °C. A rule for the graphic construction of isopleths of equivalent potential temperature is given.

AWS TR 105-6 (ATI-70922) *Critique of Verification of Weather Forecasts*, Forecast Branch, Weather Division, Hq AAF, January 1944, 84pp. Discusses rationale for forecast verification, gives examples of definitions and concepts, notes on weather classes. With annotated bibliography containing summaries of 55 articles on verification.

AWS TR 105-7 (ATI-112490) *Final Report on the Use of Symmetry Points in the Pressure Curves for Long-Range Forecasting*, by B. Haurwitz, March 1944, 7pp. Final report on study by the Meteorology Department, Massachusetts Institute of Technology. Summarizes study results and explains why the symmetry property of pressure curves (although a common phenomenon) can't be used for forecasting.

AWS TR 105-8 (ATI-65138) *Preliminary Report on Cloud Conditions Over the North Atlantic, January - March 1944*, by 2nd Lt. Albert W. Badanes, September 1944, 23pp. Weather observations over the North Atlantic were made, with particular reference to cloud formations, by three C-54 weather airplanes, from January through March 1944. Data was obtained on "flyable" days; conclusions are for conditions, routes, and tracks forecast as "flyable." About 15 percent of flying time was spent in cloud. Average altitude was about 20,000 feet. Forms of icing encountered separated into types. Frontal cloud structure studied to discover any regular layer-like vertical pattern with clear spaces through which aircraft could be routed. Fronts classified as cold, warm, or occluded, with further separation into "strong," or "weak" types. Data indicates it's usually possible to fly in the clear through any front except a strong occlusion. Optimum night levels for various types of cloud conditions are tabulated.

AWSTR 105-9 (AD-NONE) *A Rational Method of Constructing High Altitude Weather Maps*, August 1944, 7pp. Describes method for drawing 20,000-foot and 10-km charts to partly overcome lack of wind or pressure observations.

AWS TR 105-10 (ATI-72476) *Preliminary Report of Meteorological Program of San Jose Island, Panama*, Weather Division, Hq AAF, September 1944, 23pp. The results of a study at San Jose Island to determine the influence of jungle vegetation and terrain on those meteorological elements of importance to the diffusion of gas clouds in the jungle.

AWS TR 105-11 (ATI-72849) *Non-Frontal Cumulus Clouds on the North Atlantic Routes*, AAF Weather Station, Massachusetts Institute of Technology, January 1945, 16pp. Preliminary report on a climatological and statistical study of the frequency, height, and location of non-frontal or air-mass cumulus clouds on three of the principal North Atlantic routes during January, February, and March of 1944. Results compiled from observations made by six AAF weather officers flying the Atlantic in C-54 weather reconnaissance planes.

AWS TR 105-12A (ATI-65141) *Preparation of a Classification Graph East Asia—West Pacific Synoptic Region, January 1899 through June 1939, Part I*, Meteorology Department, California Institute of Technology, February 1945, 93pp. Fundamental, ideal

synoptic sequences for the East Pacific synoptic region are provided as basis for analogues to be used in the preparation of extended forecasts.

AWS TR 105-12B (AD-NONE) *Classification Graph East Asia—West Pacific Synoptic Region, January 1899 through June 1939, Part II*, CIT-AAF Research Unit, December 1944, 6pp. As an aid in selecting analogues, the classification graph presents a visual index of similar daily synoptic patterns with modifications for 1 January 1899 through 30 June 1939. Ideal types indicated by color blocks. Note: This report is not available from DTIC; a few color copies are archived at AFWTL.

AWS TR 105-13 (ATI-72495) *A Checklist for Forecasting Southern California Stratus*, AAF Research Weather Station, University of California at Los Angeles, 1945, 35pp. A short report on a joint Army-Navy-Weather Bureau study conducted during the 1944 stratus season under the auspices of the Joint Meteorological Committee. Illustrates how the knowledge of stratus behavior derived from the 1944 studies and combined with other forecasting tools give promising forecast results.

AWS TR 105-14A (ATI-65147) *Preparation of a Classification Graph East Asia—West Pacific Synoptic Region, January 1899 through June 1939, Part I*, Meteorology Department, California Institute of Technology, 30 June 1944, 65pp. A progress report in the development of a classification graph for the East Asia, West Pacific, and North American synoptic regions. Purpose of investigation was to develop a reliable and efficient method of analogue selection. Forty years (1899-1939) daily synoptic sea-level Northern Hemisphere historical weather was used as the data source. Preliminary investigation revealed the existence of several well-established, 3-day synoptic sequences that recurred with high frequency. A brief description of the principal features of each synoptic weather type for the region is given. Preliminary types have been developed for all seasons. All data shown in composite charts and graphs.

AWS TR 105-14B (AD-NONE) *Classification Graph East Pacific Synoptic Region, January 1899 through June 1939, Part II*, May 1945. Note: Not available from DTIC; contact AFWTL.

AWS TR 105-15 (ATI-114522) *Analysis and Forecasting of Tropical Cyclones of 1944 in the Caribbean Sea and Western Atlantic Ocean, with the Aid of Aircraft Reconnaissance Reports and Rawins*, extracts from report by Maj. I.I. Porus, May 1945, 30pp. A study of 11 tropical disturbances, storms, and hurricanes that entered or were formed in this area in 1944.

AWS TR 105-16 (ATI-70921) *Direct Observational Methods for the Determination of Swell Characteristics From Aircraft*, Weather Division Hq AAF, June 1945, 8pp. Outlines procedures for making simple observations of sea swell from a moving airplane. No special instruments or devices are needed, but some type of floating marker may be helpful in making an independent determination of wave period.

AWS TR 105-17 (ATI-72846) *Forecasting Tops of Non-Frontal Cumulus Clouds in Polar-Air Outbreaks over the North Atlantic*, AAF Weather Station, Massachusetts Institute of Technology, September 1945, 44pp. Gives initial procedures and discusses specific forecasting problems. Provides test of the method and conclusions. With references and weather ship data appendix.

AWS TR 105-18 (ATI-65129) *Computation of Approximate Ballistic and Differential Ballistic Winds Over Japan by Use of the Wind at Bombing Altitude*, Hq AWS, May 1945, 4pp. A statistical study of winds at Tatenno, Japan, in an attempt to find a good approximation of the ballistic wind knowing only the wind at bombing altitude. Study based on upper-air observations at Tatenno for 1923-1936.

AWS TR 105-19 (AD-242217) *Catalogue of Predictors Used in Local Objective Forecast Studies*, by Capt. Charles S. Cushman, 15 July 1960, 85pp. Provides AWS activities a catalog of predictors that have been used in existing forecast studies. Data is in tabular form, by category; for example, thunderstorms, precipitation fog/stratus, ceiling/visibility, wind, temperature/frost, miscellaneous.

AWS TR 105-20 (ATI-65125) *The Relation Between Average Monthly Cloudiness and the Average Number of Clear and Cloudy Days*, AAF Weather Service, October 1942, 7pp. Describes a new relationship between average cloudiness (percent) and type of day (clear, ptyly cldy, cldy). Tables and graphs.

AWS TR 105-21 (AD-NONE) *Sky Brightness and Illumination Data for Scandinavia, European Russia, the Arctic, and Washington D.C.*, February 1943, 49pp. Admittedly based on scant data from all locations, including U.S.S.R.'s Institute of Actinometry and Atmospheric Optics and Washington D.C.

AWS TR 105-22 (AD-NONE) *Soil Trafficability in Military Operations*, Weather Information Branch, Hq AAF, September 1943, 25pp. Discusses abilities of soil to support military traffic; gives weather factors, vegetation, soil classification; includes tables and figures.

AWS TR 105-23 (AD-NONE) *Simultaneous Ceilings at Reyjavik and Akreyri, Iceland*, 1942, 2pp. Adapted from U.S. Weather Bureau (Statistics Division) Special Report 9. Results are from correlation tables prepared for 1937 and 1938.

AWS TR 105-24 (AD-NONE) *Status and Methods of Long Range Forecasting Studies*, Weather Information Branch, Hq AAF, September 1943, 18pp. A summary of long range forecasting capabilities, circa 1943. From the introduction: "Long range weather forecasts are prepared and disseminated by the Weather Information Branch of Headquarters Army Air Forces on the premise that a long range forecast of value is the connecting link between climatology and short range forecasting, and is necessary as an aid to tactical planning of military operations."

AWS TR 105-25 (ATI-65128) *Study of Length of Record Needed to Obtain Satisfactory Climatic Summaries for Various Meteorological Elements*, Weather Information Branch, Hq AAF, November 1943, 15pp. Results of a study to determine number of years required to obtain a relatively constant frequency distribution of various weather elements, including: visibility, cloud height, cloudiness, rain persistence, wind speed.

AWS TR 105-26A (AD-NONE) *Short Range Forecast Verification Program*, November 1943, 31pp. From the latter part of 1941 until late 1943, the AAF's Weather Information Branch conducted experiments to ascertain desirable methods of forecast verification. Specific tests were conducted from August to December 1942, during which a selected group of Weather Information Branch forecasters made special short range forecasts for representative stations in North America. Traditional

verification methods were found inadequate, but newer methods (described) were also found and tested.

AWS TR 105-26B (AD-NONE) *Short Range Forecast Verification Program*, June 1944, 11pp. A supplement to AWS TR 105-16A.

AWS TR 105-21 (AD-NONE) *Ideal Station Spacing for Meteorology*, by Robert G. Stone, November 1943, 4pp. Suggests "ideal" station spacing for forecasting and climatology in round numbers.

AWS TR 105-28 (ATI-72475) *Clouds of the Aleutian Islands*, Weather Central, Alaska, September 8, 1943, 29pp. A collection of aerial photographs, annotated with descriptions, effects on aviation.

AWS TR 105-29 (ATI-72458) *Interpretation of Weather Over the Pacific*, Weather Division, Hq AAF, June 1944, 26pp. A general and month-by-month analysis of weather over the Pacific Ocean.

AWS TR 105-30 (AD-NONE) *Forecasting by Statistical and Synoptic extrapolation*, by Maj. R.A. Bundgaard, May 1944, 318pp. A resume of a mathematically derived method to predict flow patterns in the upper troposphere. Discussion founded on hypothesis that all surface disturbances of a weather map are closely related to changes in air flow at some upper level, say the 500-mb surface.

AWS TR 105-31 (AD-NONE) *Meteorological Aspects of High-Altitude Flight*, by Robert G. Stone, December 1944, 28pp. Prepared at request of AAF Board. Discusses weather conditions that affect high altitude (above 10,000 feet) flight.

AWS TR 105-32 (ATI-91843) *Forecasting and Related Problems in China*, Weather Division, Hq AAF, December 1944, 25pp. A collection of papers on various subjects related to weather forecasting in China. Papers selected from those submitted by USAAF forecasters working in China; includes techniques and ideas acquired there.

AWS TR 105-33 (ATI-65140) *Synoptic Weather Associated with Rhine Floods*, Weather Division, Hq AAF, December 1944, 65pp. A study of synoptic situations leading to the flooding of the Rhine lowlands, as requested by the commanding general, Advance Headquarters, USSTAF. Discussions of a number of

situations representative of flooding along the Rhine are given; enough climatic information is provided to give background for the synoptic situation. Hydrology is not considered. Bibliography.

AWS TR 105-34A/B (ATI-72446) *Weather and Climate of China--Parts A and B (Synoptic)*, Weather Division, Hq AAF, March 1945, 573pp. Part A (by Dr. Edwin R. Biel, Rutgers University) is a general discussion of the climate of China, together with data accumulated from various published sources at the University of Chicago. Part B consists of frequency distributions of weather elements and operational tables for selected stations compiled by the Weather Division's Climatological Section. Note: Hardbound version at AFWTL; not available from DTIC.

AWS TR 105-34C (ATI-72446) *Weather and Climate of China--Part C (Climatic)*, Weather Division, Hq AAF, March 1945, 69pp. A discussion of the synoptic features of the weather in China, with examples of synoptic weather maps illustrating the various features. Part C by Capt. John V. Finch and associates of the 2nd Weather Region. Note: Hardbound version at AFWTL; report is not available from DTIC.

AWS TR 105-35 (ATI-72894) *Regions of Orographic Lifting and Foehn with Northwesterly and Southwesterly Gradient-Wind Flow*, (from Herman Flohn, *Witterung und Klima in Deutschland*, 1942), AAF Weather Service, undated, 4pp. Includes two maps showing northwesterly and southwesterly flow, two pages of accompanying notes.

AWS TR 105-36A/B (ATI-70924) *Synoptic Aspects of the Climate of Japan: A Preliminary Report*, Weather Division, Hq AAF, March 1945, 245pp. Presents certain features of Japan's climate that affect military operations according to direction of the gradient wind. Gradient flow classified from synoptic charts drawn for the hours 0600 and 1800 local time of the meridian of 135 degrees east. Statistics based on a 5-year record, 1931-34 and 1936 (except Formosa data, 1932-34 and 1936).

AWS TR 105-37 (ATI-49691) *Report on the Off-Season Operations of the Air Force Hurricane Office, 1947-1948*, Hq AWS, July 1948, 43pp. A study of specific weather reconnaissance problems, including improved use of reconnaissance, selection of best techniques, and determination of problems requiring

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basic research. Includes storm penetration techniques (B-17, B-29) and summary of 1947 hurricane season.

AWS TR 105-38 (ATI-56149) *Short Range and Extended Forecasting by Statistical Methods*, by George P. Wadsworth, Massachusetts Institute of Technology, February 1948, 202pp. Final report on a contract study by the Division of Industrial Cooperation, MIT. Explores statistical analysis of meteorological and climatological data in relation to weather forecasting, discusses research in application of statistical techniques to long range forecasting. Includes introduction to analogues, forecasting by analogues.

AWS TR 105-39 (ATI-56149) *Further Studies of Thunderstorm Conditions Affecting Flight Operations: Turbulence*, Hq AWS, 15 March 1949, 31pp. The result of studies by Roscoe R. Braham, Jr., and Capt. Fred W. Pope of the USWB-AF-Navy-NACA Thunderstorm Project. Discusses turbulence, distribution of gusts and drafts in thunderstorms, and their relation to other weather elements.

AWS TR 105-40 (ATI-67051) *Report on the 1948-49 Post-Analysis Program of the AF Hurricane Office*, by Capt. Hugh W. Ellsaesser, June 1949, 41pp. Report covers the second year of off-season studies of the Air Force Hurricane Office at Miami. Contains brief descriptions of each storm occurring during the 1948 season, a critique of advisories, flight summaries, weather observers' reports.

AWS TR 105-41 (ATI-94442) *Report on Project Albedo, Phase I*, by Capt. Walter E. Warner, June 1949, 16pp. Report covers project initiated February 1947 by 308th Reconnaissance Group (Weather) to determine amount of radiant energy reflected and absorbed by clouds and haze. Test aircraft: RB-29 equipped with prototype pyrliometer.

AWS TR 105-42 (ATI-63797) *Report on Post-Analysis of Typhoons in the Western North Pacific 1947*, July 1949, 32pp. A descriptive summary of tropical storms occurring in the western North Pacific during 1947. Describes origins and dissipations, compares observation with hypothesis, compares forecasting techniques. Material drawn from post-analysis reports by Typhoon Warning Network made up of AWS units at Harmon AB, Guam, Haneda AB, Japan; Kadena AB, Okinawa; Clark AB, Phillipines; and Kaingwan AB, Shanghai, China. Recon flown by 514th Reconnaissance

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Squadron (VLR), Weather, from North Guam AFB, Guam.

AWS TR 105-43 (ATI-134899) *Report on the Typhoon Post-Analysis Program (1948-1949) of the North Pacific Typhoon Warning Service*, August 1951, 60pp. Report on technical findings of Hq AWS Typhoon Post-Analysis Board. Describes Pacific Typhoon Warning Network, analyzes each 1948-49 storm, summarizes recon operations.

AWS TR 105-44 (ATI-65137) *Preliminary Correlations of the Synoptic and Winds Aloft Charts with High Winds on the Natal-Ascension Track*, by TSgt. A. W. Orr 1945, 63pp. A study to correlate synoptic features with "high winds" (equal to or greater than 20 knots from 50 degrees to 130 degrees on the entire Natal-Ascension track). Study performed because 21-23 knot headwinds found sufficient to cancel about 80 percent of ascension-bound flights. Charts, tables, conclusions.

AWS TR 105-45 (ATI-66145) *Forecasting Summer Fog at Shemya*, by Capt. Dale E. Leipper, 1 June 1945, 54pp. A four-part study: basic considerations of the problem; forecast graphs, forms, and instructions; method development and statistics, and charts and instructions for applying the system at other stations.

AWS TR 105-46 (ATI-65127) *Aircraft Icing Over Northwest Europe*, by 1st Lt. Holt Ashley, 2 June 1946, 15pp. Report based on data from 9th Weather Reconnaissance Squadron (Prov) flying P-51B and P-51D aircraft on 1,340 successful tactical weather reconnaissance missions from 3 June 1944 to 3 May 1945. One or more instances of icing reported on 307 missions—only three aircraft forced to turn back or land because of icing. Data breakdown by seasons. Conclusions. Note: One archival copy available only at AFWTL.

AWS TR 105-47 (ATI-65142) *Notes on Mountain Meteorology: Briefing Aids, Northwest Ferry Routes*, February 1946. Discusses problems and techniques of weather forecasting in mountainous areas. Describes briefing aids for Northwest Ferry Route. The lee-trough phenomenon used for accurate analysis and forecasting in mountainous areas such as northwestern Canada is considered. Techniques used to obtain upper-air data for forecasting are summarized. General techniques for forecasting the ferry route from Whitehorse, Yukon

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Territory, to Fairbanks, and for the Watson Lake area, are outlined.

AWS TR 105-48 (ATI-65154) *Study of Blowing Dust in the 19th Weather Region (North Africa-Middle East)*, by Lt. A.L. Sarvis, February 1945, 105pp. An assembly of all available statistical data on blowing dust as it affects 19th Weather Region stations (Tripoli, Benghazi, Payne Field, Lydda, Habbaniya, Abadan, Teheran, Masirah, Salala, Aden, Khartoum, El Fasher, El Geneina, and Kano). Summarizes forecasting methods submitted by those stations.

AWS TR 105-49 (ATI-65153) *A Study of Harmattan Haze at Maiduguri, Nigeria*, by Capt. Thomas P. Condrón, December 1944, 13pp. Harmattan haze, more intense and persistent at Maiduguri than at any other 19th Weather Region station, consists of settled dust particles and is caused by cold northerly circulation around the eastern periphery of the Azores high or the southeastern periphery of the Russian high. This circulation sweeps across North and Central Africa behind a cold front associated with an intense Mediterranean low. Northeasterly circulation is almost always present during harmattan season. Strong outbreaks don't arrive unless there is a well-developed high in North Africa. Included: data for forecasting harmattan haze onset, tables for forecasting intensity.

AWS TR 105-50 (ATI-65151) *The Meteorology of Central Africa*, by Maj. S.B. Solot, November 1943, 13pp. With revisions by author, November 1945. A comprehensive survey of Central African weather. Discusses general circulation in lower troposphere, air mass properties, the intertropical front, haze, dust, and sandstorms, harmattan haze, rainfall in the Sudan, dynamic climatology. Includes suggestions on map analysis, techniques used in study.

AWS TR 105-51 (ATI-65134) *An Application of Kinematic Analysis to Tropical Weather*, by CWO Earl C. Kindle, May 1945, 46pp. Some notes on discussions of the 9th Weather Region's tropical technical consultant team, 1944. Includes discussion of dynamic meteorological concepts from a physical viewpoint. Discusses vorticity, divergence, divergenes, convergence and trajectories, relationship of trajectories to streamlines.

AWS TR 105-52 (ATI-65123) *Pilot Interviews: Composite Pirep of 7,500 Trips Through the Tropical*

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Front, by Capt. Leo Alpert, November 1944, 104pp. Prepared from completed questionnaires issued by the 6th Weather Region's Research Team. Questionnaire responses represent the experiences of Army and Navy pilots who made repeated flights through the equatorial front. Compiled to give weather forecasters a better understanding of the front's physical composition, movement, and intensity.

AWS TR 105-53A (ATI-65143) *Forecasting Manual Tripoli to Kamchi—Part One: October-November-December*, by Capt. Thomas P. Condrón, et al., October 1944, 94pp. The first in a series of four seasonal reports prepared by the 19th Weather Region's research section. Reports outline principal forecasting problems along the Tripoli-Karachi route and gives techniques for their solution. Capt. Thomas P. Condrón, et al., October 1944, 94pp. Included: discussions of Mediterranean low, climatology data for Tripoli, Benghazi, Cairo, Deversoir, Lydda, Habbaniya, Teheran, Abadan, Bahrein, Sharjah, and Karachi. Charts and tables. Note: All four manuals (including the three below) registered under same DTIC number, all on roll film negatives at DTIC. Low quality paper copies on file.

AWS TR 105-53B (ATI-65143) *Forecasting Manual Tripoli to Karachi—Part Two: January-February-March*, January 1945, 71pp. Note: Low quality paper copies at AFWTL.

AWS TR 105-53C (ATI-65143) *Forecasting Manual Tripoli to Karachi—Part Three: April-May-June*, April 1945, 68pp. Note: Low quality paper copies at AFWTL.

AWS TR 105-53D (ATI-65143) *Forecasting Manual Casablanca to Karachi—Part Four July-August-September*, July 1945, 122pp. Note: Low quality paper copies at AFWTL.

AWS TR 105-54 (ATI-65139) *Analysis and Forecasting of Tropical Cyclones with Special Reference to the Atlantic Ocean*, by Gordon E. Dunn, USWB, January 1944, 35pp. A study of the characteristics, development, detection, movement, and forecasting of the tropical cyclone. Includes report on reconnaissance flight in the area of the 12 October 1943 tropical storm southwest of St. Lucia.

AWS TR 105-55 (ATI-65152) *Probability of Cloud Obstructing Vision During Bombing Run*, by Maj. N. Allen Riley, 10 November 1944, 11pp. Investigates

probability of successful bomb runs when sky obscured by cloud. Probability tables would be of tactical-significance if a rule-of-thumb method could be found to determine the average distance between clouds. When target attacked with less than about 50 percent probability, it appears that small independent bomb elements, sufficiently spaced over the target, represent best bombing practice.

AWS TR 105-56 (ATI-65155) *Rain-Cloud Weather Reports Associated with the Frontal Passage of 17-20 December 1943 in Panama*, November 1944, 51pp. A study of rain clouds observed on radar during wet season passage of a "norther," or tropical cold front. Note: DTIC copy low contrast—not reproducible.

AWS TR 105-57 (ATI-65133) *Radar Storm Detection—Panama 1944*, 1945, 122pp. Discusses findings of the 6th Weather Region's radar section during the Panama wet season of 1944. Main purpose is to give weather forecasters comprehensive knowledge of radar observation methods and limitations of the RAREP code. Fundamental radar principles are included in an appendix, along with a discussion on the use of the RAREP code.

AWS TR 105-58 (ATI-65149) *Pressure Tendency as an Aid in Single-Station Forecasting for Tropical Areas*, by Lt. George L. Landgren and Maj. G.M. Leies, March 1945, 14pp. In equatorial regions, changes in sea-level pressure are very small when compared to those in temperate latitudes. This report presents the results of a study to determine the magnitude and characteristics of pressure tendencies at one tropical weather station (Pitoe Strip on Morotai Island in the Netherlands East Indies) to determine whether or not they are a satisfactory single-station forecasting tool. The study concludes that pressure tendencies in themselves are not a satisfactory tool for single-station tropical forecasting.

AWS TR 105-59A (ATI-65144) *The Utilization of 500 Millibar Charts in Forecasting for the China Area—Spring Season*, by Capt. Robert B. Orton, June 1945, 6pp. Forecasters at the Weather Central have been analyzing 500-mb charts since 1 December 1944. The decision to draw charts for this level was based primarily on a need for accurate wind forecasts at and above this level, and any value derived from their use in forecasting actual weather was considered of less importance. Therefore, a study was begun to determine what use might be made of the 500-mb chart in answering some

of China's forecasting problems. Study period: 15 February 1945 to 15 May 1945—findings are outlined here.

AWS TR 105-59B (ATI-83514) *The Paths and Characteristics of Migratory Anticyclones in Southeast Asia*, by Capt. Robert B. Orton, July 1945, 15pp. This report acquaints forecasters who have little access to weather data outside the geographical borders of China with some of the weather phenomena that occur beyond the northernmost reporting stations but that are closely associated with weather in China.

AWS TR 105-60 (ATI-78584) *A Wave-Front Method of Minimal Flight Planning*, by D.T. Perkins, October 1949, 7pp. A geometrical method for minimal-flight planning, formally similar to the application of Huygens' principle, is described. The method uses a simple geometrical construction applied to the contour field as an aid in attaining best possible flight paths from time and fuel economy standpoints. The construction affords a simple and practical extension to three-dimensional night planning, a problem that appears to be outside the scope of the differential method.

AWS TR 105-61 (ATI-73177) *An Analysis of the Sea Breeze in the Boston Area*, by Maj. William E. Klein, et al., June 1945, 78pp. Documents an extensive sea breeze study in the Boston area during 1944. Mean and extreme values of sea-breeze characteristics are tabulated, and the importance of coriolis force in causing steady clockwise turning of the wind during sea-breeze periods is illustrated. The dependence of the sea-breeze effect on friction and curvature of coastline, as well as various methods for evaluating the sea-breeze effect are discussed.

AWS TR 105-62 (ATI-84239) *The Computation of Air Trajectories*, by Maj. Arthur F. Gustafson, June 1950, 30pp. From time to time, AWS forecasters are required to compute air trajectories. Procedures have not been adequately treated in the literature nor standardized among meteorologists. This report critiques various existing methods and determines the procedure that is most accurate and feasible with the synoptic data generally available.

AWS TR 105-63# (AD-NONE) *Principles of Reduction of Pressure to Sea Level and Compilation of Altimeter Setting*, 1948, revised 1950. Note: "Rescinded" and discarded in 1951.

AWS TR 105-64 (AD-NONE) *Radiosonde Observation Computation Tables and Diagrams (Second Edition)*, September 1952. Provided working set of tables and diagrams required to evaluate circa 1950 radiosonde observations; a reprint of the 1 June 1950 edition. AWSTR 105-64A, 1 June 1964.

AWS TR 105-65 (AD-203353) *List of Stations Reporting Pressures Reduced to Datum Other Than Mean Sea Level*, Synoptic Code, by C.J. Callahan, 1 June 1958, 101pp. Includes Change A, 8 August 1960. A listing of weather stations that report pressures reduced to a datum plane other than mean sea level in the SYNOP code FM11. Basic data source: WMO Publication No. 9, TP 4. Appendix 1 gives instructions, tables, and figures for converting pressures reduced to various levels to pressures reduced to sea level.

AWS TR 105-66 (ATI-93532) *Thickness Evaluation Charts and Tables*, December 1950, 12pp. See AWS TR 230, formerly AWSM 105-50/2. Includes Amendment #1, April 1951. Gives height and thickness data for aircraft ascent and descent soundings. All heights in geopotential feet.

AWS TR 105-67 (ATI-83513) *The Frontology of North China*, by Capt. Robert B. Orton, September 1945, 91pp. Report confined to discussion of characteristics and behavior of Fronts affecting weather conditions in north China—an area arbitrarily defined as that part of China proper north of 30 degrees north. Conclusions based primarily on data collected, and synoptic charts drawn, at the Weather Central, Hsinching, From December 1943 to September 1945. As radiosonde data From east China were lacking during this period, prewar soundings were used. Analysis of these data in east China primarily the work of Dr. Chang-Wang Tu, supplemented by work of other Chinese meteorologists.

AWS TR 105-68 (ATI-111292) *Dew-Point Charts*, January 1951, 5pp. Provides standard methods for computing and reporting dew point and dew-point depression (from data obtained with Psychrometer ML-313/AM) in night level and ascent/descent sounding weather reconnaissance reports.

AWS TR 105-69 (ATI-92528) *Theory and Design of a Gradient Wind Scale*, by Maj. Arthur F. Gustafson, November 1950, 15pp. Includes Change A, 27 April 1951. Describes a simple but accurate gradient wind scale with applicability to all AWS charts.

AWS TR 105-70 (ATI-104137) *Comparison of Analogue Selection Methods*, by Lt. Col. Rodney A. Jones, April 1961, 37pp. An objective analysis of an investigation of analogue methods selection used by the Air Force during and immediately after WWII (ca. 1946). Shows successes and suggested improvements.

AWS TR 105-71 (ATI-93006) *Report on Elmendorf Weather*, January 1946, 38pp. A complete report on the weather of Elmendorf Field, Alaska, with explanations of causes and associated synoptic conditions.

AWS TR 105-72 (ATI-119241) *Dew Point—Relative Humidity Conversion Chart*, April 1951, 5pp. Used for aerial reconnaissance weather observations; this chart provides a direct graphic method for converting from dew-point temperature to relative humidity and vice versa.

AWS TR 105-73 (ATI-98238) *Forecasting Fog in the Brahmaputra Valley*, by Lt. Col. Donald E. Martin and MSgt. P.W. Bauer, March 1951, 17pp. Presents certain practical aids to forecasting fog in the Brahmaputra Valley of India and to aid in indoctrinating forecasters new to the area. Methods outlined in this report were used successfully by numerous forecasters in India during WWII.

AWS TR 105-74 (AD-NONE) *Corrections for Temperature Indicator D-271/AMQ-2 and Humidity Indicator ID-272/AMQ-2*, May 1951, 7pp. Report provides a direct method for obtaining corrections to indicated values from ID-271/AMQ-2 and ID-272/AMQ-2. AWS weather reconnaissance aircraft equipped with aerograph equipment (AN/AMQ-2) modified by removal of Recorder ML-320/AMQ-2 and addition of ID-271 (temperature) and ID-272 (humidity) indicators.

AWS TR 105-75 (ATI-98239) *An Example of Easterly Wave Analysis in the Western Pacific 9-16 July 1945*, by Dr. Reid A. Bryson, March 1951, 11pp. Initially a part of Dr. Bryson's doctoral dissertation to the University of Chicago. Summarizes techniques in use while Bryson was on active duty as a major at the Guam Weather Central in the latter days of WWII. Notes that ordinary analysis techniques are generally unsatisfactory for study of easterly waves, and that they must be supplemented by time-sections, streamlines, and specialized cloud observations

AWS TR 105-76 (AD-NONE) *Some Aspects of Hurricane Forecasting*, June 1951, 31pp. Describes ideas adopted by the Air Force Hurricane Office during the 1947-50 hurricane seasons. Adapted from "Hurricane Post Analysis Program, 1950," produced by AF Hurricane Office, Miami, Fla., 6 April 1951.

AWS TR 105-76A (AD-NONE) *Some Aspects of Hurricane Forecasting*, May 1955, 9pp. Brings AWS TR 76 up-to-date, corrects certain errors.

AWS TR 105-77 (ATI-110565) *Hurricanes of 1950: Narrative History of Each Storm and Comments on Hurricane Reconnaissance*, July 1951, 90pp. A narrative history of each storm of the 1950 hurricane season, with comments on reconnaissance, and recommendations.

AWS TR 105-78 (ATI-114511) *Forecasting Typhoons of 1949 with Special Reference to the Use of Streamline Analysis*, August 1951, 50pp. Prepared by the Typhoon Post-Analysis Board at Anderson Weather Central, Guam, primarily for indoctrination of inexperienced tropical forecasters.

AWS TR 105-79 (ATI-114514) *Non-Frontal and Other Types of Thunderstorms in the Lee of the Rocky Mountains*, by Capt. John B. Young, December 1945, 16pp. Acquaints forecasters with basic types of thunderstorms that occur east of the Rockies; namely, Kansas, Nebraska, Colorado, New Mexico, and the Panhandle regions. Issued by AWS August 1951.

AWS TR 105-80 (AD-NONE) *On the Propagation and Growth of Jet Stream Waves*, by Dr. Sverre Pettersen, November 1951, 37pp. Amendment No. 1, 24 March 1952. Deals with the theory underlying growth and movement of circulation patterns at high levels, in particular the jet stream regime.

AWS TR 105-81 (AD-NONE) *The Cirrus-Forecasting Problem*, November 1951, 11pp. A preliminary report on studies of cirrus occurrence.

AWS TR 105-82 (ATI-122474) *An Area Forecasting Study for the Southeastern United States*, by Brig. Gen. J.J. George and Capt. R.D. Roche, USAFR, November 1951, 53pp. Study concentrates on types of weather that are generally a problem to aircraft operations in the southeastern United States, and is confined largely to synoptic situations causing low ceilings, stratus, and fog.

AWS TR 105-83 (ATI-122473) *Notes on Forecasting for Resupply Operations to Canadian Arctic Stations 1951*, November 1951, 16pp. Includes discussions of several broad-weather patterns for terminals at: Resolute Bay, Mould Bay, Isaachsen, Eureka Sound, Alert Bay, and Thule. Also includes general discussions of haze, cloud cover, twilight, convection, blocking effects, frontal analysis.

AWS TR 105-84 (ATI-167313) *Wind Estimation from State of Sea Observations*, February 1952, 12pp. A guide for estimating surface wind speeds by observing the state of the sea surface from weather reconnaissance aircraft. Photographs are included.

AWS TR 105-85 (AD-NONE) *Chromov's Synoptic Rules*, February 1952, 24pp. Amendment No. 1, March 1952, 2pp. Translated from Russian. Consists of 177 rules intended as practical forecasting aids, published in 1937 by Dr. S.P. Chromov, a Russian meteorologist. First issued by 28th Weather Squadron as a technical note from DA Sub-Project 80.11. Contents as published were not evaluated, and publication was not to be construed as official AWS approval of Dr. Chromov's views.

AWS TR 105-86 (ATI-162082) *Tropopause Analysis and Forecasting*, by Dr. George P. Cressman, March 1952, 31pp. Outlines procedure for constructing tropopause charts and tropopause prognostic charts. Includes discussion of the basis for recommendations and examples. Describes and defines tropopause, discusses upper air analysis.

AWS TR 105-87 (ATI-173319) *A Preliminary Evaluation of the Meteorological Worth of Sferics Data*, March 1952, 18pp. See AWS TR 105-102. A brief summary of one phase of an AWS study to determine the meteorological significance of sferics observations. Includes a concise history and explanation of the "sferics" (short for "atmospherics") program.

AWS TR 105-88 (ATI-143061) *Report on Task Force Weather Central Activities During Operation GREENHOUSE*, March 1952, 24pp. A summary of problems encountered by AF and Navy forecasters on Eniwetok in providing weather support to Operation GREENHOUSE. Includes discussion of techniques used, general remarks, conclusions on forecasting for Eniwetok.

AWS TR 105-89 (ATI-143040) *Report on the Post Analysis of Typhoons in the Western North Pacific, 1950*, April 1952, 27pp. Describes analysis and forecasting techniques employed by the Guam Post-Analysis Board during their review of the 1950 typhoon season. Consists of large extracts from the "1950 Annual Report of the Typhoon Post Analysis Program of the North Pacific Typhoon Warning Service of the 2143rd Air Weather Wing." Includes narrative storm histories, tracks, and characteristics.

AWS TR 105-90 (AD-NONE) *Forecasting the Long Waves in the Upper Westerlies*, June 1952, 40pp. A summary of several methods for forecasting motion and development of wave patterns in the upper westerlies, along with limitations of these methods. Especially designed for forecasters in weather centrals concerned with upper-level forecasting.

AWS TR 105-91 (ATI-147201) *The Occurrence of Strong Winds at Thule*, by Capt. Adam Ehrlich, May 1952, 8pp. Study initiated as a result of request for assistance in forecasting the very strong, super-gradient winds that occur frequently at Thule, Greenland. Although specifically aimed at Thule winds, techniques may be applied to other stations, especially along the west coast of Greenland.

AWS TR 105-92 (ATI-157976) *Forecasting Winter Ceilings at Barksdale Air Force Base*, by Lt. Col. Charles L. Bristor, et al., July 1951, 45pp. Discussion of the development organization, application, and evaluation of a forecasting system for Barksdale AFB.

AWS TR 105-93 (AD-029380) *A Description of Some Methods of Extended-Period Forecasting*, March 1954, 90pp. Change A, October 1954, 1p. A brief description of the various methods or systems for extended range forecasting that appear to have any rational meteorological basis; mean circulation methods used by the USWB and the AWS discussed in greater detail. Since most of these methods are controversial, no final opinions or decisions on their validity can be made.

AWS TR 105-94 (AD-059988) *Some Important Weather Factors in B-47 Flight Operations, second revision*, October 1954, 18pp. Discusses weather criteria for B-47 night planning and operations.

AWS TR 105-95 (AD-014211) *Forecasting Study for Turner Air Force Base*, by L.D. Roche, et al., April

1953, 55pp. Report intended as a model for local forecast studies. Only forecasters at Turner and certain other bases in the southeast will be able to make direct operational use of this report, but forecasters at locations troubled with advection stratus fog, radiation fog, mixing-radiation stratus, and prewarm front stratus will find the discussions useful.

AWS TR 105-96 (AD-017729) *Analysis and Wind Flow at the 50- and 25-MB Levels*, by Dr. Adam Kochanski, May 1953, 76pp. Describes investigations of region above 100 mb (50,000 feet), particularly at 50 and 25 mb (82,000 feet), in attempt to derive techniques for analysis of constant-pressure charts and a picture of the wind flow.

AWS TR 105-97 (AD-NONE) *The Use of Weather Radar in Weather Forecasting with Particular Reference to Radar Set AN/CPS-9*, November 1952. Gives latest state of the art of using radar in weather forecasting. Serves as a guide for units still using AN/APQ-13s or those equipped with the newer AN/CPS-9. Procedures developed under government sponsored research contract with MIT's Department of Meteorology. Superseded by AWS TR 184.

AWS TR 105-98 (AD-074309) *Use of Geostrophic Distance in Analysis and Forecasting*, Maj. G. DeGiacomo, September 1954, 13pp. Proposes another way to consider geostrophic wind on maps and wind scales.

AWS TR 105-99 (AD-003774) *Tables for Computing Constant Absolute Vorticity Trajectories*, by H. B. Wobus, et al., 17 December 1952, 12pp. Contains tables for computing CAV trajectories entered on larger area weather charts to forecast the long wave in the westerlies, as explained in AWSM 105-90; useful at weather centrals and area forecast centers.

AWS TR 105-100/1 (AD-095566) *Anomalies in the Northern Hemisphere 700-mb 5 Day Mean Circulation Patterns*, April 1956, 26pp. Provides background for use of the so-called "Martin anomaly charts" in AWS TR 105-100/2. Based on studies by Lt. Col. Donald E. Martin that led to technique for forecasting large-scale pressure patterns with anomaly charts. Suggestions for use in 5-day, 24- to 72-hour forecasting.

AWS TR 105-100/2 (AD-095567) *Atlas of 700 mb, Five-Day Mean Northern Hemisphere Anomaly*

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Charts, July 1955, 39pp. For use with AWS TR 105 100/1; gives more explicit instructions for 24- to 72-hour forecasting.

AWS TR 105-101 (AD-145387) *Memorandum on Density-Altitude, second revision*, September 1957, 7pp. Purports to "provide such information on density-altitude as Air Weather Service personnel are likely to need."

AWS TR 105-102 (AD-043882) *Final Report on the AWS Sferies Evaluation Project (1951)*, by Capt. Clayton E. Jensen, August 1954, 152pp. Give full results of AWS project to evaluate the meteorological worth of sferics; history, planning, conclusions, project personnel and cost. Includes photos, maps, charts, and references.

AWS TR 105-103 (AD-005226) *An Analysis of Some Contrail Data*, February 1953, 13pp. The results of an analysis of contrail observations to see whether a forecasting technique proposed by AWSM 105-1(X), April 1952, was valid. Data used in checking validity from B-36 and B-47 aircraft in the United States, F-84 and F-86 in Europe.

AWS TR 105-104 (AD-005288) *An Estimate of the Contrail Problem*, 1 February 1953, 26pp. Report intended for use of staff planning units in agencies concerned with effects of contrail problems on combat operations.

AWS TR 105-105 (AD-005201) *Memorandum on Construction of a Device for Measuring Contour Curvature*, March 1953, 5pp. Gives instructions for making a device to measure contour curvature using thin plexiglass, dividers, French curve, and India ink.

AWS TR 105-106 (AD-005221) *A Preliminary Forecasting Study for Thule, Greenland*, by A.D. Belmont, March 1953, 5pp. Study prepared in 1949 on the basis of the author's 1-year experience at Thule as a U.S. Weather Bureau forecaster. Reproduced by permission with minor changes. Gives rules for forecasting Thule winds, clouds, and precipitation. Useful in forecasting in and for Greenland and northern Canada's arctic archipelago.

AWS TR 105-107 (AD-013056) *Mean Monthly Maps of 300-, 200-, 100-, 50-, and 25-mb Surfaces Over North America*, by Dr. Adam Kochanski, April 1953. A new series of mean contour and isotherm charts for the higher levels of the atmosphere of operational

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interest, but for which no charts (or inadequate ones) have been available heretofore. Oversize (10" x 14").

AWS TR 105-108 (AD-020871) *Temperatures at the 10-mb (101,000-foot) Level*, by Dr. Adam Kochanski, May 1953, 33pp. Extends discussion of levels above 200 mb, begun in AWS TR 105-96, to 10 mb, which is as high as present radiosondes reach with any frequency and accuracy. Preview of problems with analysis and forecasting at 10 mb.

AWS TR 105-109 (AD-030340) *Forecasting Sudden 700-mb Height Changes in Key Areas*, by Maj. Adam Ehrlich, April 1953, 5pp. Extract one of a larger report. Key area covered: At 60 degrees north, from 0 degrees to 10 degrees east, over the western end of the Scandinavian Peninsula.

AWS TR 105-110 (AD-021743) *Memorandum on Estimating the Height of Cirrostratus Clouds*, by Herbert S. Appleman, June 1953, 8pp. Gives instructions for a test method for estimating heights of cirriform clouds.

AWS TR 109-110A (AD-129546) *Test of Method for Estimating the Height of Cirrostratus Clouds*, by Herbert S. Appleman, January 1957, 7pp. Appendix A to AWS TR 105-110. Gives further data from Project CLOUD TRAIL established by Air Defense Command with the 3rd Weather Group to collect high level weather data from jet aircraft. Results do not lead to alterations of procedures in TR 105-110.

AWS TR 105-111 (AD-NONE) *Report on Project Red Fang: A Test of Operational Utility of the Amchitka Automatic Weather Station*, May 1953, 20pp. The first operational installation of the Army Signal Corps' "Automatic Weather Station, Fixed," was in August 1951 on Amchitka Island, about halfway between Shemya and Adak in the Aleutian chain. The station measured continuous sunshine, rainfall, wind direction/speed, pressure, temperature, and relative humidity, transmitting data every 3 hours in CW. More in AWS Bulletin, November 1952. This report gives results of evaluation by a 7th Weather Group project nicknamed RED FANG.

AWS TR 105-112 (AD-026922) *A Further Analysis of Contrail Data*, December 1953, 40pp. Like AWS TR 105-103, this report tests validity of technique proposed by AWSM 105-100, "Forecasting Jet Aircraft

Condensation Trails." Also tests a piston-engine contrail technique.

AWS TR 105-113 (AD-024099) *The AWS Runway Air-Density Program*, October 1953, 21pp. The results of a survey of requirements for runway temperature observations. Includes analysis of distribution of differences found between runway and instrument shelter temperatures.

AWS TR 105-114 (AD-022231) *Wind Extrapolation Device (AWS-WPC-10-4)*, by Maj. G. DeGiacomo, November 1953, 10pp. Discusses some of the vectorial operations that can be performed with the newly designed wind extrapolation device.

AWS TR 105-115 (AD-072873) *Mean Cross Sections Along 80° W*, by Dr. Adam Kochanski, February 1955, 39pp. Number 5 in a series of background report for AWS Manual 105-50; others are AWS TRs 105-86, 105-96, 105-107, 105-108, 105-121, 105-128, and 105-129. Gives information on the distribution of isotachs of the westerly component of mean flow, mean isotherms, and mean tropopause along the 80 degrees west meridian from the North Pole to the equator and from sea level to about 31 km.

AWS TR 105-116 (AD-A954915) *Tables for Computing Horizontal Distance of Pilot Balloons (30 Gram) for Use with the ML-462()/UM-Nozzle*, November 1953, 121pp. A reprint of United States Weather Bureau Tables (WB Form 1043). Tables designed to replace slide rule in computing horizontal component of a 30-gram pilot balloon's distance from the theodolite at any given whole minute after release.

AWS TR 105-117 (AD-A955095) *Tables for Computing Horizontal Distance of Pilot Balloons (100 Gram) for Use with the ML-462()/UM-Nozzle*, November 1953, 151pp. A reprint of United States Weather Bureau Tables (WB Form 1043). Tables designed to replace slide rule in computing horizontal component of a 100-gram pilot balloon's distance from the theodolite at any given whole minute after release.

AWS TR 105-118# (AD-NONE) *Weather Factors in Atomic Warfare*, February 1954. Change AWS TR 105-118A, March 1954. Details unknown.

AWS TR 105-119 (AD-NONE) *A Survey of Worldwide Upper Air Observing Stations*, June 1954, 59pp. A

consolidated listing (by WMO region) of all upper air observing stations reported to the World Meteorological Organization as of October 1953.

AWS TR 105-120 (AD-055556) *An Introduction to Numerical Weather Prediction*, November 1954, 28pp. Report prepared by Joint GRD-AWS Numerical Prediction Project under direction of Maj. Philip D. Thompson. Gives brief history of numerical weather prediction, describes establishment, status, and plans for Joint (WBAN) Numerical Weather Prediction Unit. Includes introductory theory and methods.

AWS TR 105-121 (AD-060095) *Winds Over 100 Knots in the Northern Hemisphere*, by Maj. Francis W. Murray, January 1955, 67pp. Number 6 in a series of background reports for AWS Manual 105-50. Report discusses conditions under which very strong winds are likely to be observed in the free atmosphere (3,000 to 60,000 feet). Only actual wind reports used in study. Principal characteristics of winds more than 100 knots were directional distribution, frequency distribution with height, and associated shear. Special study of winds over 100 knots at lower latitudes and special study of winds much stronger than 100 knots.

AWS TR 105-122 (AD-050871) *The Military Grid Reference System*, 15 October 1954, 12pp. An early reference source for AWS people required to work with the Military Grid Reference System (MGRS). Note: AWSR 50-55 is the current operational MGRS reference.

AWS TR 105-123# (AD-NONE) Title and status Unknown.

AWS TR 105-124 (AD-038469) *1951 Annual Report of Typhoon Post-Analysis Program*, August 1954, 77pp. Prepared by AWS detachment at Guam; includes only technical part of original report.

AWS TR 105-125 (AD-038468) *1952 Annual Report of Typhoon Post-Analysis Program*, August 1954, 43pp. Fifth annual report of the Typhoon Post-Analysis Board, Andersen AFB, Guam.

AWS TR 105-126 (AD-074310) *Memorandum on Effect of Engine Power Sensing on Contrail Formulation and Intensity*, by Herbert S. Appleman, August, 1954, 6pp. Based on a study of 2,000 observations by F-84 aircraft, part of a program to test

validity of the Appleman contrail curves (AWSM 105-100). Evaluates effects of power setting on contrail formation.

AWS TR 105-127 (AD-104611) *Weather Information from B-47 Flights*, by Dr. Karl R. Johannessen, October 1955, 37pp. Based on studies made by AWS Project BLACK SHEEP. Discusses B-47 weather instrumentation, kinds of observations, and procedures for recording and transmitting. Appendices.

AWS TR 105-128 (AD-100947) *Mean Contours, Isotachs, and Isotherms Over the Northern Hemisphere at the 300-, 200-, and 100-mb levels*, January, February, July, and August 1949, by Dr. Adam Kochanski, November 1954, 45pp. Number 7 in a series of background reports for AWS Manual 105-50. Gives picture of mean flow and temperature patterns at high levels over the entire Northern Hemisphere. Maps give mean contours, isotachs of mean geostrophic flow, and isotherms at 300, 200, and 100 mb for January, February, July, and August of 1949. Conclusions and limitations.

AWS TR 105-129 (AD-079472) *Thermal Structure and Vertical Motion in the Lower Stratosphere*, by Dr. Adam Kochanski, December 1954, 36pp. Number 8 in a series of background reports for AWS Manual 105-50. Gives synoptic characteristics of temperature and wind flow from the tropopause to 70 mb in latitudes 35-70° N. UCLA models of thickness for the 300-200 and 200-100 mb layers and of isotherm patterns for 200 and 100 mb are described.

AWS TR 105-130 (AD-141546) *A Compendium on Cirrus and Cirrus Forecasting*, by Robert G. Stone, March 1957, 156pp. Indicates effects of cirrus on military operations, notes requirements for cirrus forecasting. Various methods for forecasting reprinted from original sources, including Sandia Corp. Considerable climatological data included.

AWS TR 105-131 (AD-079448) *Fjortoft's Graphical Method for Preparing 24-hour 500-mb, Prognostic Charts*, by Dr. Karl R. Johannessen, April 1955 11pp. Gives results of Hq AWS trials, verifications, and modifications of the Fjortoft method. Original and modified procedures described in detail.

AWS TR 105-132 (AD-101313) *Preliminary Results of Project CLOUD TRAIL*, by Dr. Robert D. Fletcher, February 1956, 23pp. Gives findings based on winter

and spring data collected in Project CLOUD TRAIL. Data used to improve forecasting of contrails, cirrus, and high-level turbulence.

AWS TR 105-133 (AD-075863) *Accuracies of Radiosonde Data*, by V.S. Hardin, September 1955, 12pp. Summarizes best available information on errors in radiosondes in current use in USA. Elementary discussion of statistical terms and concepts used for expressing accuracy or error is discussed.

AWS TR 105-134 (AD-069809) *Evaluation of Mr. Grappe's Extended Period Forecasting Technique*, by Maj. R. A. Bundgaard, May 1955, 20pp. In 1950, Roger Grappe of the French Meteorologie Nationale developed a method of extended period forecasting for periods up to 30 days, based in large part on the concept of similarities. After Mr. Grappe visited Hq AWS for trials and verifications, an extended forecasting method using some of Grappe's procedures was developed. This report summarizes the results of various AWS experiments with the Grappe method, with conclusions.

AWS TR 105-135 (AD-156453) *Charts of Maximum and Minimum Thickness Lines 1000/500 mb, Northern Hemisphere, 1946-50*, 30 September 1952, 26pp. Charts (24) prepared by Dr. R.C. Sutcliffe, Meteorological Office, Dunstable, England. Accompanying text (2pp). Charts oversize (12" x 15").

AWS TR 105-136 (AD-147760) *Some Objective Methods for Forecasting 300-mb and 200-mb Winds, A Preliminary Report*, by Dr. Adam Kochanski, November 1957, 14pp. Describes three methods for forecasting winds at 200 and 300 mb. Results compared with other methods, i.e., NAWAC progs, climatology, and persistence.

AWS TR 105-137 (AD-072807) *Atlantic-European Weather Types, 1899-1945: Classification, Calendar, Uses and Climatology*, by Lt. Col. Olaf Njus, August 1955, 40pp. Contains description of classification of weather types for the Atlantic-European area, a type-catalog or calendar in digital form showing the types for each day of the years 1899-1945, a suggested color code for making the calendar into a chart, discussion of the uses of the types and calendar, and statistical tables showing type climatology for the period.

AWS TR 105-138/1 (AD-072808) *Evaluation of the Eastern Air Lines Prognostic-Chart Method, Part 1*,

Cyclogenesis, by Thomas H. Simmonds, August 1955, 28pp. In August 1953, AF Cambridge Research Center published techniques for prognostic chart construction in the United States, developed by J.J. George and associates at Eastern Airlines. In June 1954, the airline published Scientific Report No. 2, revising certain procedures. Papers described empirical methods for handling problems such as cyclogenesis, movement of certain types of cyclones, etc.; this report evaluates those techniques for AWS use.

AWS TR 105-138/2 (AD-104612) *Evaluation of the Eastern Air Lines Prognostic-Chart Method, Part II, Movement of Cyclones, Anticyclones and Fronts*, by Thomas H. Simmonds, October 1955, 8pp. Continued evaluation of techniques not covered by Part I.

AWS TR 105-139 (AD-095565) *The Black Sheep System of Forecasting Winds for Long-Range Jet Aircraft*, by Lt. Col. R.A. Bundgaard, et al., March 1956, 48pp. Describes wind forecasting system developed from AWS Project BLACK SHEEP for B-47 and other long-range jet aircraft. Verification, recommendations.

AWS TR 105-140/1 (AD-122395) *Errors in Upper-Level Wind Forecasts*, by Maj. Hugh W. Ellsaesser, December 1956, 17pp. Discusses errors in prognostic winds at 700, 500, 300, 200, and 100 mb. Includes recommendations for reducing error.

AWS TR 105-140/1A (AD-146322) *Errors in Upper-Level Wind Forecasts, Change A*, by Maj. Hugh W. Ellsaesser, November 1957, 7pp.

AWS TR 105-140/2 (AD-145386) *An Investigation of the Errors in Upper-Level Wind Forecasts*, by Maj. Hugh W. Ellsaesser, November 1957, 58pp. A detailed analysis of errors in prognostic winds for 700, 500, 300, 200, and 100 mb.

AWSTR 105-141 (AD-097052) *Studies of 2-Hour and 4-Hour Upper-Wind Variabilities Over Nevada*, February 1956, 9pp. Special wind sounding data from Nevada Proving Ground for 1 March to 1 May 1954 at 2- and 4-hour intervals are analyzed statistically for layers 6-14, 16-20, 25-35, and 40-50 thousand feet.

AWS TR 105-142 (AD-107275) *Wind, Temperature and Their Variabilities to 120,000 feet*, by Dr. Adam Kochanski, May 1956, 34pp. Number 9 in a series of background reports for AWSM 105-50. Acquaints forecasters with variability (or persistence) of wind and

temperature up to 120,000 feet. Data for four sections close to the 70° W meridian and ranging from 28° N to 61° N, and for months of August 1954 and January 1955.

AWS TR 105-143 (AD-084104) *On Ultrapolar Circulation Patterns*, by Dr. P. Mildner and H. Barrels, November 1955, 68pp. Prepared on completion of an experiment in long-range forecasting conducted at Rhein-Main Weather Central 1949-1954.

AWS TR 105-144 (AD-115669) *An Investigation Into the Morphology of Time Series of 500-mb Heights*, by Dr. Karl Eger, August 1956, 43pp. A report on an experiment in long-range forecasting conducted by Dr. Eger at Rhein-Main Weather Central, 1949-1954. Charts, figures, references.

AWS TR 105-145 (AD-125760) *Derivation of Jet-Aircraft Contrail-Formation Curves*, by Herbert S. Appleman, January 1957, 46pp. Presents data and calculations on which AWSM 105-100 based. New tables and graphs.

AWS TR 105-146 (AD-NONE) *Estimating the Probability of Hurricane-Force Winds Affecting an Air Base*, by Capt. Stanley J. Kimball, June 1958, 15pp. Provides an objective means for estimating the chances of a base being affected by hurricane winds of a storm whose forecast track indicates a possibility that base will be struck. Tables and nomograms for Atlantic/Caribbean and western North Pacific.

AWS TR 105-147 (AD-141542) *Clear-Air Turbulence From 25,000 to 45,000 Feet Over the United States*, by LeRoy H. Clem, July 1957, 13pp. Presents findings of a study of high-level turbulence obtained from Project CLOUD TRAIL aircraft. Turbulence observations collected above 25,000 feet by aircraft flying in vicinity of upper-air sounding stations. Report shows that high-level turbulence may be associated with recognizable synoptic features and that it has systematic geographical and seasonal variations.

AWS TR 105-148 (AD-208895) *An Error Analysis of Geostrophic 300-mb Numerical Wind-Speed Forecasts*, by Maj. Walter J. Saucier, September 1958, 2pp. A report on the accuracy of experimental daily 24-hour 300-mb wind speed forecasts produced by numerical weather prediction models. Det. 2, AWS, computer program extracted 300-mb grid-point geostrophic wind speeds from JNWPU baroclinic prognostic charts. Forecast errors studied for 8 day period, summer 1958.

AWS TR 105-149 (AD-218079) *A Digest of Objective Methods for Forecasting Strong Surface Winds (Southwestern United States—Early Spring)*, by Thomas H. Simmonds, April 1959, 83pp. A guide to forecasting strong, gusty surface winds in southwestern United States. Data from 15 air bases used in study.

AWS TR 150 (AD-254659) *Air Density Profiles for the Atmosphere Between 30 and 80 Kilometers*, by Roderick S. Quiroz, January 1961, 46pp. Presents data for 65 individual air density soundings taken 1947-1958 and at altitudes from the equator to 75 degrees north. All values reduced to grams/cubic meters. Data from several rocket firings above the mesopause included.

AWS TR 151 (AD-254761) *Seasonal and latitudinal Variations of Air Density in the Mesosphere (30 to 80 Kilometers)*, by Roderick S. Quiroz, March 1961, 16pp. The results of analysis of mesosphere data, along with four other soundings. Lowest densities found in winter in arctic latitudes. At 65 km, mean winter density 60 percent of mean summer density. Seasonal variation in midlatitudes relatively small—less than 5 percent below 50 km, maximum of 13 percent at 66 km. Latitudinal gradient greatest in winter at around 65 km. Gradient directed northward from midlatitudes, 2 percent per degree (at 65 km); smaller gradient directed equatorward from midlatitudes. At midlatitudes, standard deviation of density varies from 4 percent (of mean density) at 30 km to about 20 percent near 60 km, remaining nearly constant to top of the mesosphere. In Arctic latitudes, standard deviation varies from 11 percent at 30 km to a maximum of about 40 percent near 60 km, decreasing to about 30 percent at 80 km.

AWS TR 152 (AD-261937) *Preparing the Regional Surface Prognosis at the Tokyo Weather Central*, by Maj. Herbert Edson, April 1961, 58pp. A semi-objective procedure for preparing 30-hour regional surface prognoses at the Tokyo Weather Central on an operational basis. These prognosis charts normally cover an area of some 55 degrees of latitude by 140 degrees of longitude.

AWS TR 153 (AD-259120) *Percentiles of Air Density at Station Level*, by Dr. Adam Kochanski, May 1961, 42pp. Method given for estimating certain percentiles of density at station level for any discrete point over Northern Hemisphere. Main operational problem requiring knowledge of density distribution concerns SAC bombers on 15 minute alert. Runway-density lower

than a certain critical value can prevent takeoff of heavy aircraft. Helicopter hover is also affected by low density. Technique reconstructs that part of cumulative frequency curve for density that lies between 5th and 95th percentile. Technique lets one estimate six points of the curve. Accuracy of estimate varies. Method devised to give very high accuracy for the 5th, 10th, and 20th percentiles (low densities). For higher-than-average densities (80th, 90th, and 95th percentiles), technique allows only rough estimates.

AWS TR 154 (AD-258525) *The Meteorological Factors Affecting Photographic Reconnaissance from Very High Altitudes*, by Karl R. Johannessen, May 1961, 8pp. A brief survey of obscuring factors (other than clouds) affecting aerial photography from very high altitudes. Numerical data on aerosols and optical turbulence included.

AWS TR 155 (AD-NONE) *Effects of Variable Atmospheric Density on the Deceleration of Reentry Vehicles*, by Karl R. Johannessen and Charles F. Roberts, August 1961, 37pp. The results of a study requested by AFBMD and Space Technology Laboratories. Although application here is to the GE Mark 3 Reenter Vehicle, the method can be applied to any reentry problem in which density is a factor.

AWS TR 156 (AD-424736) *List of Meteorological Research Papers (M.R.P.'s) of the British Air Ministry Meteorological Research Committee 1942-1958, Released to U.S. Defense Activities*, 1 November 1963, 34pp. Formerly AWSP O-1—redesignated AWS TR 156 by AWS/DNTI letter, 1 February 1974. British MRPs began during WWII when most research was classified and not published in civilian journals. The series continued until 1958 as a means of provisional distribution pending formal publication elsewhere. The AWS received a number of these unpublished papers. Some were registered with ASTIA (now DTIC) and are indicated by their AD- or ATI-numbers.

AWS TR 157 (AD-263474) *Applications of Infrared Measurements in Meteorology*, by Lt. F.B. Wouse and Capt J.R. Blankenship, June 1961, 16pp. An introduction to the application of infrared technology to USAF systems and to meteorology.

AWS TR 158 (AD-244597) *High Level Turbulence*, by J. Clodman, G.M. Morgan, Jr., and J.T. Ball, New York University, September 1960, 84pp. Reprint of final

report under contract No. AF19(604)-5208. Authors worked under Project Director, Professor Miller of Department of Meteorology and Oceanography at New York University. During an evaluation of clear air turbulence forecasting methods, Hq AWS requested and got permission to reprint the contact report verbatim.

AWS TR 159 (AD-267339) *Estimates of Altitudes with Specified Probabilities of Being Above All Clouds*, by Irving Solomon, October 1961, 18pp. Results of efforts by USAF Climatic Center to determine graphic method for estimating probabilities of being above all clouds. Results provided designed as basic planning tool for long-range purposes.

AWS TR 160 (AD-029375) *Bibliography on Small-Scale Time and Space Variations in the Free Atmosphere*, March 1954, 6pp. Formerly AWSP O-14-redesignated AWS TR 160 by AWS/DNTI letter, 1 February 1974. Designed to be of interest to activities designing and testing upper-air measuring equipment of aircraft missiles and accessories. Also of interest in solving upper-air diffusion, synoptic analysis problems.

AWS TR 161 (AD-269491) *Climatic Aspect of Ballistic Wind and Density*, by William C. Spreen, Rolf M. Nilsestuen, and Oscar E. Richard, November 1961, 60pp. Climatological behavior of ballistic wind and density is examined, using means of equally weighted values of upper-air wind and density at altitudes 2 km apart. These mean values are termed integrated wind and density, respectively. Three integrated values of wind and density are used—one for the atmosphere below 12 km, another for the atmosphere below 16 km, and one for the zone below 24 km. Data from 25 stations in the Northern Hemisphere, chosen from widely diverse climatic regimes, are used. Specific aspects of behavior examined: effects of variability on short-period means; comparison of monthly and seasonal statistics; effects of restricted amounts of data; and relation of integrated density to integrated wind.

AWS TR 162 (AD-272183) *Climatological Probability of Fallout from Multiple Nuclear Detonations*, by Col. Thomas D. Potter, January 1961, 8pp. Gives a method for determining climatological probability of fallout from multiple nuclear detonations. A general procedure for a simple case of two detonations, based on probability of two events occurring together, was developed by applying a vector regression equation to effective wind variables at the two points of detonation. This was

followed by an extension of the development to include three or more detonations.

AWS TR 163 (AD-436538) *Wind-Shear effects on Airspeed*, by J.A. Brown, Transworld Airlines, March 1962, 18pp. A change in airspeed will occur whenever an aircraft traverses from one wind condition to another in less time than aircraft ground speed can adjust to the new wind component. Recommended flight procedures include allowances for these variations; there is no danger of getting into difficulty as long as proper airspeed is maintained. Extreme conditions of wind shear encountered during approach can be hazardous if corrective action not taken immediately on thrust and/or flight control settings. Knowing how various types of wind shear can affect airspeed should help pilots anticipate the effects of windshear and allow them to take prompt and appropriate action.

AWS TR 164 (AD-286695) *Estimating the Probability of Operationally-Critical Wind Speeds Affecting an Air Base During the Passage of a Tropical Cyclone*, by Herbert S. Appleman, August 1962, 22pp. Formerly AWS TR 105-146. Balancing the cost of protection against the damage incurred by tropical storms requires certain decisions, such as whether to tie down or evacuate aircraft, delay construction projects, remove missiles from firing pads, etc. Decisions to take such actions is based primarily on expectancy of occurrence of wind speeds above a critical value considered hazardous to the installation. To balance cost of protection against damage incurred at an unprotected base, commanders must know the probability of an installation being struck by above-critical wind speeds. In June 1958, AWS published a report (AWS TR 105-146, AD 218 559) that outlined a method for computing total probability of above-critical wind speeds affecting an air base at some time during passage of a hurricane or typhoon. A technique was developed for obtaining the instantaneous probability of strong winds affecting a base at each hour during the storm's passage, and a somewhat different approach was used to obtain the hour-by-hour instantaneous probability. This report describes both techniques, as well as several new ones.

AWS TR 164/1 (AD-298945) Amendment to TR 164, January 1963, 8pp.

AWS TR 165 (AD-293168) *Forecasting Density Altitude*, by Capt. Norman N. Richardson, November

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1962, 31pp. Prepared primarily as a result of problems associated with helicopter operations at remote sites. Provides nomogram and simple, step-by-step instructions for forecasting density altitude. Includes extensive table of machine-computed density altitude values.

AWS TR 166 (AD-256922) *Bibliography of Documents Prepared by Weather Staff Sections of Headquarters Army Air Corps and Headquarters Army Air Forces, 1937—June 1945*, April 1961, 60pp. Formerly AWSP 0-18/2—redesignated AWS TR 166 by AWS/DNTI ltr, 1 February 1974. Several thousand technical documents were prepared by the organization for weather of the Army Air Forces during WWII. Some of those documents are listed here. Appendix lists U.S. War Department publications on weather or applicable to AAF weather operations.

AWS TR 167 (AD436603) *Estimated Frequencies of Specified Cloud Amounts Within Specified Ranges of Altitude*, by Irving Solomon, April 1963, 53pp. Study designed to provide military planners, design engineers, and AWS personnel with estimates of frequencies in which specified cloud amounts will be encountered within specified altitude ranges. Information shown by isopleths on Northern Hemisphere base maps for midseason months. These data will furnish inputs for strategic planning of environmental support to a system or operation; for example, selecting design criteria for equipment, determining feasibility of an operation, and establishing long-range operational plans. Tactical, or short-range, planning should be based on synoptic weather forecasts that give go/no-go advice.

AWS TR 168 (AD-337244) *Programs for Determining the Minimum Re-Entry Dispersion Due to Atmospheric Variability*, by Karl R. Johannessen, May 1963, 48pp. The results of a study requested by the Ballistic Systems Division, AFSC, to examine meteorological factors during reentry of Project SLEIGH RIDE vehicles. An optimum fuzing program, which helps eliminate burst-height errors caused by meteorological fluctuations, emerges as a result of this study.

AWS TR 169 (AD422637) *Computation of Atmospheric Refractivity on the USAF Skew-T, Log-P Diagram*, by Karl R. Johannessen, September 1963, 7pp. Elements needed to compute refractive index are pressure, temperature, and dew point. Vertical distribution of these quantities is recorded and displayed

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on Skew T, Log P diagram (AWS WPC 9-16), from which refractivity can be read directly from traces of temperature and dew point. Refractive index can be evaluated directly from the plotted sounding without an external nomogram, and necessary height values can be entered. Accuracy and range of computations should cover AWS detachment applications.

AWS TR 170 (AD-420922) *Estimating Wind Forecast Errors for Specific Locations, Altitudes and Seasons*, by Karl R. Johannessen, September 1963, 11pp. Originally a report from the Physical Scientist's Office, Hq AWS. Reissued as TR 170.

AWS TR 171 (AD420921) *Relative Humidity Errors Resulting from Ambiguous Dew-Point Hygrometer Readings*, by Herbert S. Appleman, September 1963, 7pp. Instruments currently used in weather stations for measuring humidity work very well at high temperature, but become increasingly inaccurate at temperatures below freezing because of the small amount of water vapor in the air. Consideration is being given to using a dew point hygrometer, an instrument able to detect small quantities of moisture with great accuracy. Over a considerable temperature range below 32° F, unfortunately, the instrument may record either dew point or frost point. This study was to determine whether this ambiguity would lead to significant error in computed relative humidity. It was found that the effect was large enough to affect accuracy of current techniques for forecasting moisture-dependent phenomena and suggests instrument designs that eliminate the problem.

AWS TR 172 (AD-344505) *Effects of Atmospheric Variability on the Mark 15 Reentry Vehicle*, by Karl R. Johannessen, 1 September 1963, 53pp. Report considers the effects of the variable atmosphere on the inertial component of the Mark 15 Reentry Vehicle. Contains closed form expression for altitude deviation of output signal and gives a survey of the statistical distribution of the deviation as a function of geographical location and season for several programmed burst altitudes.

AWS TR 173 (AD-259710) *Technical Publications and Documents of Air Weather Service Field Activities, Part One: 1945-1961, with a Chronology of AWS Organizations, 1945-1961*, 30 June 1962. Formerly AWSP 0-17/1—redesignated AWS TR 173 by AWS/DNTI letter, 1 February 1974. Lists technical publications and miscellaneous informal documents issued by AWS field activities since the end of WWII.

AWS TR 174 (AD-NONE) *Technical Publications and Documents of Air Corps and AAF Field Weather Activities, Part Two: 1937-1945, with a Chronology of AC and AAF Regional Organizations 1937-1945*, September 1960, 60pp. Change A, 19 February 1960, 1p. Formerly AWSP 0-17/2—redesignated AWS TR 174 by AWS/DNTI letter, 1 February 1974. Lists documents prepared by various field weather service activities or the Air Corps from 1937 to 1941 and the Army Air Forces from 1941 to 1945. Chronology of AC-AAF weather organizations included.

AWS TR 175 (AD-431703) *Upper-Stratosphere Density and Temperature Variability Determined from Meteorological Rocket Network Results, 1960-1962*, by Roderick S. Quiroz, Capt. J.K. Lambert, and 1st Lt. J.A. Dullon, December 1963, 48pp. Gives results of Climatic Center project involving derivation of density profiles from 256 rocket temperature observations made 1960-62. AWS TR 175/1A, March 1964, 1p.

AWS-TR-176 (AD-440508) *Diffusion Forecasting for TITAN II Operations*, by Lt. Col. R.L. Miller and Capt. F.H. Miller, 10 February 1964, 32pp. Provides meteorologists with information and procedures to use as a basis for answering questions and giving advice on atmospheric diffusion of TITAN II propellants. Includes tables and graphs based on new and improved prediction equation developed at AFCRL and using combined Dry Gulch, Ocean Breeze, and Prairie Grass data.

AWS-TR-177 (AD-696619) *An Introduction to Weather Modification*, by Herbert S. Appleman, September 1969, 38pp. Weather modification techniques explained; AWS activities in cloud-seeding and fog-dissipation experiments discussed.

AWS TR 178 (AD-NONE) *Least Dispersion of the Mark 12 Reentry Vehicle*, by Karl R. Johannessen, September 1964, 54pp. Analyzes the reentry induced dispersion of the Mark 12 Reentry Vehicle and defines a fuzing program that results in the least dispersion in a given impact region. The result of a request from Ballistic Systems Division/AFSC, Norton AFB.

AWS-TR-179 (AD-724092) *Lightning Hazard to Aircraft*, by Herbert S. Appleman, April 1971, 13pp. Gives latest available information on lightning hazards to jet aircraft. Included are temperature and altitude ranges where most strikes are encountered, a brief

discussion of likely damage, and a more detailed look into possibility of fuel-tank explosion due to lightning and electrostatic discharge. Although the possibility of explosion is small, aircraft with JP-4 fuel are generally more vulnerable than those using gasoline or kerosene.

AWS-TR-180 (AD-609305) *Preliminary Operational Application Techniques for AN/TPQ-11*, by United Aircraft Corporate Systems Center with technical assistance from ARACON Geophysics Co., September 1964, 106pp. Report based on recent studies and analyses using a modified prototype AN/TPQ-11 Radar Cloud Detecting Set. Data resulted in modifications incorporated in production set now being placed in USAF inventory. Simultaneous with modifications was a plan to interpret improved data for forecasting. This document reflects preliminary conclusions and provides firm reference for the recognition and interpretation of most cloud types. By periodic updating and extrapolation of permanent facsimile record, it's possible to forecast arrival and cessation of precipitation, sunshine, and fog breakup at AN/TPQ-11 sites. In addition, probable icing and turbulence can be forecast for areas adjacent to AN/TPQ-11 installations.

AWS-TR-181 (AD-446389) *On the Origin and Climatology of Noctilucent Clouds*, by Roderick S. Quiroz, August 1964, 29pp. A review of existing concepts of constitution or origin of noctilucent clouds. A mechanism is suggested that might explain their apparent dependence on latitude. Their frequency of occurrence with respect to latitude, longitude, time of year, and other factors, is analyzed in detail. Year-by-year changes in number of occurrences are considered in relation to the "11-year" sunspot cycle. A comprehensive sample of data on cloud movement is summarized, although in view of the highly complicated field of motion in noctilucent clouds, this subject is difficult to treat satisfactorily. Comparison made of rocket samples of particle size and concentration, with values deduced from polarization measurements.

AWS TR 182 (AD-NONE) *Estimated Frequencies of Potential Icing Conditions at Specified Altitudes*, by Maj. David M. Ingram and TSgt. Jimmie L. Gullion, September 1964, 17pp. Percentage frequencies of potential icing conditions at specified altitudes shown by isopleths on Northern Hemisphere base maps for midseason months. Superseded by AWS TR 194; see Section 2.

AWS TR 183, VOL 1 (AD-A041877) *Estimating Meteorological Effects on Radar Propagation, Volume I, Text*, by W.B. Moreland, January 1965, 198pp. A comprehensive reference in radio-radar meteorology. Volume I explains principles and procedures. With one page pen and ink change, 3 June 1965.

AWS TR 183, VOL 2 (AD-A041878) *Estimating Meteorological Effects on Radar Propagation, Volume II, Appendices*, by W.B. Moreland, March 1965, 162pp. Contains appendices to Volume I of same title. Included are tables of the CRPL exponential reference atmosphere, ray tracing diagrams (of Wong), and nomograms and maps with instructions for determining and forecasting D-Values. Origin of these materials and general procedures for use explained in Volume I.

AWS TR 184 (AD466187) *General Application of Meteorological Radar Sets*, by United Aircraft Corporation Systems Center with technical assistance from ARACON Geophysics Co., March 1965, 126pp.

AWS TR 185 (AD-609493) *Practical Interpretation of Meteorological Satellite Data*, by William W. Widger, Jr., Paul E. Sherr, and C.W.C. Rogers of ARACON Geophysics Co., September 1964, 427pp. Consolidates information pertinent to operational interpretation of meteorological satellite data, specifically for AWS forecasters. Extracts, integrates, and summarizes material available in literature and technical reports through early 1964. Topics include coverage, scale, and resolution of satellite data, operationally available data formats, coordination with other meteorological data, cloud type interpretation, key features observed in pictures, extratropical vortex interpretations, other synoptic and mesoscale features, interpretations of tropical data, and contributions of satellite data to weather forecasting. Procedures for integration of satellite and conventional data, and for use of satellite data to provide improved synoptic analyses, are included. Guidance for operational interpretation, application, and value of infrared data for atmospheric windows is provided, looking toward time such data are made available to field forecasters.

AWS TR 186 (AD-630289) *Estimating Mean Cloud and Climatological Probability of Cloud-Free Line-of-Sight*, by Lt. Col. John T. McCable, November 1965, 31pp. Describes a method that provides an estimate of probability of cloud-free line-of-sight between any two levels at any angle to the horizon for locations having standard surface-observed cloud data. Method uses

mean cloud amount between surface and each higher kilometer level to estimate mean cloud amount at any level, the mean cloud amount above any level, and the mean cloud amount between any two levels. Analyses of sunshine and total cloud cover by time of day provide a basis for estimating probability of cloud-free line-of-sight through the whole atmosphere as a function of mean total cloud cover and viewing angle. This relationship is used to estimate probability of cloud-free line-of-sight at any angle between any two levels for which mean cloudiness between levels is known or estimated. Height vs distance profiles of estimated probability of cloud-free line-of-sight can be prepared manually or by computer for any kilometer height reference levels.

AWS TR 187 (AD-639566) *Regression Equations for Specifying Atmospheric Density Above 30 KM from Observational Data at Radiosonde Altitudes*, by Roderick S. Quiroz and 1st Lt. Gary J. Thompson, August 1966, 34pp. Analysis of a small rocket data sample from the Soviet observing site at Heiss Island (81 degrees north) indicated a high correlation between density of the upper stratosphere and the temperature and pressure at certain altitudes in the lower stratosphere. Strong density-temperature and density-pressure relationships may be anticipated under certain conditions from consideration of the hydrostatic equation and the equation of state, the latter differentiated with respect to height. Large samples of rocket observational data for a northerly and a southerly station were specially processed to yield correlation coefficients for all possible pairs of altitudes between 20 and 60 km. Knowledge of maxima in the vertical profiles of the correlation coefficients then made it possible to construct regression evaluations with minimum standard error of estimate. It is shown that such equations may be used to predict density satisfactorily at altitudes up to about 50 km from radiosonde observational data on the thermodynamic state of the lower stratosphere. Incidental to development of the prediction equations is a discussion of the observed patterns of the intra-level correlation of density with temperature and pressure and the inter-level correlation of density with temperature, pressure, and density, to 80 km.

AWS TR 188 (AD-645118) *Technique Development Reports—1966*, edited by Col. D.E. Marlin, November 1966, 156pp. A collection of papers on topics selected from projects under development in the AWS Technique Development Program. At the May 1966 Technique Development Conference in Washington D.C., Dr. Jule

Charney, serving as AWS consultant, led discussion on many of topics in this report. Contents:

"Some Objective Analysis Techniques Suitable for Nephanalysis," by Capt. Paul Janota, pp 1-16.

"A Computer Technique for Constructing Isentropic Trajectories," by Capt. D. R. Green, pp 17-25.

"Computer Tropical-Wind Analysis," by Maj. August L. Shumbera, Jr., pp 27-35.

"The Air Weather Service Six-Level Model," by Maj. Hugh M. O'Neil, pp 37-41.

"The Derivation of Stratospheric Density Estimates from Rocket Observations Near the Poles," by Roderick S. Quiroz, pp 43-56.

"Weather Support to Computer Flight Plans," by Maj. Alvin L. Smith, Jr., and Capt. J.R. Irwin, pp 57-63.

"Project COLD FOG I," by Capt. Ronald L. Lininger, and Herbert S. Appleman, pp 65-70.

"Fine-Mesh Limited-Area Forecasting Model," by Maj. J.G. Howcroft, pp 71-75.

"Analysis of Density Data Deduced from Low-Altitude High-Resolution Satellite Tracking Data," by Col. Leonard L. DeVries, Capt. E.W. Friday, and L.C. Jones, pp 77-90.

"Extended-Range Cloud Forecasts," by Lt. Col. J.H. Jones, and Lt. Col. W.P. Moore, pp 91-97.

"A Two-Dimensional Tropospheric Ray-Tracing Technique," by Capt. E.S. Harsh, pp 99-112.

"Weather Reconnaissance Data-Reduction Program," by Lt. Col. S.L. Williams, pp 113-133.

"Numerical Cloud Prediction," by Lt. Col. Herbert Edson et al., pp 135-143.

"Automated Weather Network," by Maj. J.D. Sharp, and Lou A. Westphal, pp 145-156.

AWS TR 189 (AD-649345) *Wind Shear and Turbulence over Selected Stations of the Air Force Western Test Range*, by Lloyd V. Mitchell, December 1966, 31pp. Gives windshear data for three areas of Air

Force Western Test Range (AFWTR), and turbulence data applicable to AFWTR for portions of the Northern Hemisphere. Method described and used for estimating means and standard deviations or wind shears for smaller layers using windshear data measured through thicker layers. Estimates of turbulence frequency and intensity based on relationship between wind shear and turbulence. Mean wind shear and wind shear variability maxima occur at approximately 40,000, 55,000, 130,000, and 220,000 feet with minima at 100,000 and 150,000 feet. Turbulence frequency and intensity maxima occur near 30,000, 130,000, and 220,000 feet with minima near 45,000, 120,000, and 150,000 feet.

AWS TR 190 (AD-651389) *An Investigation of Atmospheric Density Between Altitudes of 180 km and 300 km*, by Lt. Col. Leonard L. DeVries, November 1966, 130pp. Knowledge of atmospheric density and variation at satellite altitudes needed for operational support of several military activities. Atmospheric density data computed from decay rates of more than 40 satellites orbited during a 5-year period analyzed. Multiple regression equations derived to specify density at 10 km intervals at altitudes from 180 to 300 km as a function of solar activity, time of day, time of year, and combinations. Density values depicted by these regression equations then compared with density data not used during derivation of equations. Results indicate that multiple regression analysis and associated screening procedure can produce equations from which computed density values are in close agreement with observed density data. Results lead to conclusion that no single density model can meet all needs. Results also indicate that characteristics of a density model should be selected to fit purpose for which model intended. Four possible density models designed for different purposes suggested.

AWS TR 191 (AD-642429) *Atmospheric Humidity Atlas—Northern Hemisphere*, by I.I. Gringorten, H.A. Salmela, Irving Solomon, and Maj. J.D. Sharp, August 1966, 151pp. Includes 120 plates showing water vapor distribution in the atmosphere of the Northern Hemisphere. There are 20 plates in terms of mixing ratio at surface and 100 plates in terms of surface dew point and dew point at the 850-, 700-, 500-, and 400-mb levels. Distributions of other measures of moisture, including vapor pressure, frost point, water-vapor density, and mixing ratio aloft, are obtainable from distribution of the dew points. Plates are useful to designers estimating effects of atmospheric water vapor on aerospace

hardware and for those concerned with operation and storage of equipment. Frequency distribution plates, from 5 to 95 percent, are especially useful in estimating duration or persistence of moist conditions, as illustrated by several examples.

AWS TR 192 (AD-658014) *The Natural Environment of a Satellite in a Synchronous Circular Orbit*, by Capt. Henry W. Brandli, June 1967, 65pp. Current literature reviewed; natural environment at about 6.6 Earth radii (from Earth center) defined in terms of thermodynamic variables, geophysical variables, electromagnetic radiation environment, particle radiation environment, and meteoroid environment.

AWS TR 194 (AD-649619) *Climatological Probability of Aircraft Icing*, January 1967, 29pp. Presents seasonal Northern Hemisphere isopleth charts depicting climatological probability of aircraft icing at 5,000, 10,000, 15,000, and 20,000 feet. Also describes method used in determining these probabilities and discusses data used.

AWS TR 195 (AD-709727) *Variability of the Monthly Mean Zonal Wind, 30-60 km*, April 1970, 84pp. An analysis of the monthly mean zonal wind and the standard deviation of the zonal wind about the monthly mean. Data are presented in tables, analyses in time (months) altitude (30 to 60 kilometers) cross-section as well as profiles for selected levels. Station-by-station variability of the monthly mean zonal wind, 30 to 60 kilometers, is discussed. There is a discussion of the altitudinal, latitudinal, monthly, and seasonal variations with a designation of four seasons: winter: (dominated by westerlies but with occasional easterlies), November through March; spring: (transition of westerlies to easterlies), April and May; summer: (persistent easterlies), June through August; and fall: (transition of easterlies to westerlies), September and October.

AWS TR 196 (AD-819188) *Proceedings of the Technical Exchange Conference 4-7 April 1967*, July 1967, 296pp. A summary collection of 47 presentations made at the AWS Technical Exchange Conference, Monterey, Calif., April 1967. Authors represented Air Force, Army, Navy activities and their contractors, Environmental Science Services Administration (ESSA), and several universities. Contents: "Some Solutions to Weather Analysis Problems through the Use of Satellite Data," by Edward Ferguson, ESSA, pp 1-10.

"Application of Satellite-Picture Interpretation Principles to Analysis in Sparse Data Regions," by Maj. Golden K. Farr, 6WW, pp 11-32.

"A Satellite Cloud Photo-Interpretation Key," by Roy Lec and Charles I. Taggart, Canadian Met Service, pp 33-37.

"Quantitative Cloud Motion and Growth Information from Earth-Synchronous Satellite-Picture Pairs," by Charles L. Bristor, ESSA, pp 38.

"APT Use at Fuchu AF Weather Central," Capt. Lee G. Dickinson, 1WW, pp 39-41.

"Recent Research on the Application of Meteorological Satellite Cloud Data to Numerical Weather Analysis," by E. Paul McClain and Harold J. Brodrick, ESSA, pp 42-50.

"Utilization of Meteorological Satellite Cloud Data in a Numerical Analysis and Prediction System," by Roland E. Nagle, Meteorology International, Inc., pp 51.

"Applications of Satellite Observations of Extratropical Cloud Vortices," by William W. Widger, Jr., C.W.C. Rogers, and Paul E. Sherr, Aracon Geophysics Co., pp 52-82.

"The Need for Observing and Reporting of Solar Flares," by Capt. Hans Fischer, 6WW, pp 83-91.

"A Solar-Flare Videometer," by Paul Tallant, AFCRL, pp 92-109.

"Use of Ground-Level Neutron Monitors in a Real-Time Solar-Proton Monitoring Network," by M.A. Shea, AFCRL, pp 110-118.

"The Effect of Physical Foreshortening on Sunspot Area Measurements," by Capt. Ronald T. Podsiadlo, 6WW, pp 119-120.

"Numerical Modeling of Convection," by Francis W. Murray, Rand Corp, pp 121-125.

"Fields by Correlation Assembly," Maurice Denard, Manfred Holl, and James R. Clark, Meteorology International, Inc., pp 126.

"On the Application of Scaling Theory and Energetics to the AWS Six-Level Model," Maj. Harold B. Hart, 3WW, pp 127-132.

"A Diabetic Multi-Level Primitive-Equation Model and an Illustration of a Wave Cyclone Development," by T.N. Krishnamurti, Navy Post-Graduate School, pp 133-135.

"Monitoring Solar Cosmic-Ray Events," by G.W. Adams, ESSA, pp 136-137.

"Computer Ray-Tracing Techniques to Determine the Effects of Ionospheric Tilts to MUFs," by Alfred F. Barghausen and James W. Finney, ESSA, pp 138-143.

"Morphology of Tapside Polar Ionosphere," by Capt. C.F. Power, AWS, and Charles M. Rush, University of California, pp 146-155.

"The Computation of Atmospheric Densities Using SPADATS Data," by Capt. R.E. De Michaels, 4WW, pp 156-159.

"An Investigation of Atmospheric Density Between 180 km and 300," by Lt. Col. Leonard L. DeVries, AWS, pp 160-161.

"Results from the Two-Level Version of the NCAR General Circulation Model," by Warren M. Washington and Akira Kasahara, NCAR, pp 162-171.

"Grid Telescoping in Numerical Weather Prediction," by Geoffrey D. Hill, AFCRAL, pp 172-177.

"Objective Improvements in Numerical Prognoses," by H.B. Wobus and P.R. Lowe, NWRF, pp 178.

"The Application of Numerical Analysis of Baroclinicity to the Object Location of Frontal Zones," by Robert J. Renard, Navy Postgraduate School, pp 179-199.

"Numerical Modeling Efforts of 3rd Weather Wing," by Lt. Col. Herbert Edson, 3WW, pp 200-201.

"Techniques for Prediction of Solar Flares and Energetic-Particle Events," by Maj. Donald T. Sherry, 4WW, pp 202-206.

"The Application of Millimeter-Wave Radio Mapping to Flare Prediction," by Maj. William O. Banks, 4WW, pp 207-208.

"Short-Term Prediction of F2-Layer Maximum Usable Frequencies for Local Magnetic Activity," by Robert M. Savis, Jr., ESSA, pp 209-211.

"Short-Term Forecasting of Ionospheric Propagation for DCA Trunks in SE Asia," by R.J. Slutz, T.N. Gautier, and M. Leftin, ESSA, pp 212.

"Real-Time Specification of the Planetary Geomagnetic Index A_p ," by Capt. William F. Johnson, AWS, pp 213-214.

"Prediction of Hurricane Movement," by Banner I. Miller and R. Cecil Gentry, ESSA, pp 215-223.

Onset of Widespread Rain During Southeast Asia Summer Monsoon," by Marvin J. Lowenthal, USAECOM, pp 224-225.

"Annual Versus Daily Rainfall: Southeast Asia," by Ruth L. Wexler, Natick Labs, pp 226-242.

"The Tropical-Analysis and Forecasting Model Running Operationally at FWC Pearl Harbor," by Capt. John G. Joern, 1WW, pp 243-244.

"Diurnal Variation in Cloud Cover Over a Tropical Island Region as Shown by TIROS-VII Infrared Data," by Earl S. Merritt, Aracon Geophysics, pp 245-253.

"Short-Range Subsynchronous Surface-Weather Prediction," by Harry R. Glahn and Dale A. Lowry, ESSA, pp 254-259.

"A Mathematical Model for Air Flow in a Vegetative Canopy," by Ronald M. Cionco, USAECOM, pp 260-261.

"An Empirical Study of Low-Level Sounding Prediction," by Carl W. Kreitzberg, AFCRL, pp 262-275.

"A Low-Level Circulation Model for Diagnostic and Prognostic Applications," by Maj. Robert A. Derrickson, Jr., and Capt. Paul Janota, 3WW, pp 276.

"An Objective Precipitation and Moisture-Forecast Model," by Leo C. Clarke, FNWF, pp 277.

"Systematic Approach to Weather Presentation," by

Clement J. Todd and Steven H. Cohen, NWRF, pp 278-279.

"Teleplot," by J.W. Nickerson, NWRF, pp 280-284.

"Surface Observations of Snow and Ice for Correlation with Remotely Collected Data," by Michael A. Bilello, CRREL, pp 285-293.

"Application of Radio and Optical Path-Length Measurements to Studies of Low-Level Turbulence," by B.R. Bean and C.B. Emmanuel, ESSA, pp 294.

AWS TR 197 (AD-661979) *Summaries of Pressure, Temperature, and Density Over Cape Kennedy AFS, Including Periodic Density Variations*, by Maj. Edward V. Von Gohren, August 1967, 35pp. Summaries of Arcasonde 1A Meteorological Rocket thermodynamic data for Cape Kennedy AFS based on 1964-1966 data. Extremes, means, and standard deviations as functions of month and season shown for altitudes 80,000 through 200,000 feet. Data statistically treated to provide estimates of seasonal, diurnal, and interdiurnal periodicities at 160,000 feet over Cape Kennedy. Nomogram of atmospheric density as function of local time and month included.

AWS TR 198 (AD-659760) *Radiosonde Dew-Point Accuracies 40°C to -40°C*, by Lloyd V. Mitchell, August 1967, 27pp. In most literature, accuracies for radiosonde-measured atmospheric moisture expressed in terms of relative humidity; i.e., percent of saturation. This report presents radiosonde-measured atmospheric moisture accuracies in terms of dew point; i.e., saturation temperature. Dew point root-mean-square (RMS) errors presented in tables and in nomograms. Table and nomogram included for temperatures between 0 and 40°C and for temperatures between -40 and 0°C. Dew-point accuracies are least for high temperatures and low dew points, and greatest for low temperatures and high dew points, in each temperature group. AWS-TR-198A, January 1968.

AWS TR 199 (AD-668125) *An Evaluation of the Operational Utility of Direct Readout Infrared Satellite Data*, by Capt. Serhij Pilipowskyj, March 1968, 21pp. Study evaluates the utility of direct-readout infrared data on the basis of data obtained from Nimbus I and II spacecraft. Both spacecraft provided infrared data to a NASA central readout station. High-resolution infrared data (HRIR) recorded on 70 mm film is of photographic quality. Data sample limited to September 1964 and May

through November 1966, the operating lifetimes of the infrared systems. A large number of HRIR pictures were available for this evaluation, along with several DRIR data samples. DRIR pictures obtained from Joint Typhoon Warning Center (JTWC), Guam, where a Navy APT set had been modified to receive DRIR data. Additional study input came from a Navy DRIR evaluation, from a number of technical publications on this subject, and from personal contact with those who had worked with DRIR data.

AWS TR 200 (AD-744042) *Notes on Analysis and Severe-Storm Forecasting Procedures of the Air Force Global Weather Central*, by Robert C. Miller, May 1972, 183pp. This collection of notes discusses various types of severe-weather air masses, how severe weather systems form, which variables best define the existence and intensity of severe weather, and how to use local information to better forecast the occurrence or phenomena at individual stations. Specifically, wind gust and hail size forecasting techniques and the usefulness of various stability indexes are presented. A chapter on severe weather in tropical air masses is included. A number of detailed case studies included to help the reader visualize how forecasting concepts are applied and to emphasize the importance of forecasting experience. The revised material concentrates on the application of computer-derived aids to severe weather forecasting produced by the Air Force Global Weather Central. Foremost among these aids are analyses and prognoses of the severe weather threat (SWEAT) index. With Change 1, 31 January 1973.

AWS TR 200-1 (AD-NONE) See AWS TR 45-1.

AWS TR 201 (AD-None) *Operational Requirements and a Research and Development Plan for the Weather Radar of the 1980s (WR/1980)*, by Morton L. Barad, et al., 9 January 1973, 22pp. Also published as AFCRL-TR-73-0009, 9 January 1973, Special Report No. 151. Report written by AWS/AFCRL working group created to state operational requirements for weather radar data in 1980s and write plan for developing weather radar of the 1980s (WR/1980). Includes discussion of needs for weather radar data, employment concepts, preliminary operational requirements, technical approach for development, related R & D activities, phasing of work, and recommendations. **For Official Use Only.**

AWS TR 202 (AD-672221) *Climatological Estimates of Clock-Hour Rainfall Rates*, by Lt. Col. Donald C. Winner, June 1968, 30pp. Report expounds on an

empirical method for estimating clock-hour rainfall rates for a station when the mean annual rainfall amount and mean annual number of days with measurable rainfall are known. A climatic weighting factor is introduced in the calculations, using Thornthwaite's "moisture index." Nomograms for estimating clock-hour rainfall rates for temperate and tropic regions included. Change: AWS-TR-202/1A, October 1968.

AWS TR 203 (AD-671995) *Air Weather Service Weather-Modification Program*, by Herbert S. Appleman, May 1968, 17pp. Describes several AWS fog dissipation projects and gives results of field tests. (1) Project COLD FOG: Dissipation of supercooled fog with dry ice cakes suspended from tethered balloons. (2) Project COLD COWL: An operational project to dissipate supercooled fog with crushed dry ice dropped from an aircraft. (3) Projects COLD WAND and COLD HORN: Dissipation of supercooled fog by direct injection of liquid propane and carbon dioxide. (4) Project COLD FAN: Repeat of COLD HORN, but with the addition of a powerful vertical fan to blow resulting ice crystals aloft. (5) Project WARM FOG: Dissipation of warm fog with engine exhaust heat from parked and running C-141 aircraft.

AWS TR 204 (AD-672028) *Interrelation of Ionospheric Sporadic E with Thunderstorms and Jet Streams*, by Maj. Thomas D. Damon, May 1968, 27pp. Reports on the occurrence of ionospheric sporadic E clouds from radio amateurs operating on a frequency near 50 megahertz are analyzed on a synoptic scale and compared with the occurrences of thunderstorms and jet streams. A mechanism is suggested for the observed relationship between sporadic E (Es) and thunderstorms. No definite conclusion drawn on a possible relationship between Es and jet streams.

AWS TR 205 (AD-668439) *The Operational Dissipation of Supercooled Fog: Project COLD COWL 1967-1968*, by Herbert S. Appleman, April 1968, 16pp. In the winter of 1967-1968, AWS carried out its first operational weather-modification program at Elmendorf AFB. An AWS weather reconnaissance aircraft (WC-130E) was used to seed supercooled fog with dry ice. A prescribed flight path was flown a specified distance upwind from the target area; crushed dry ice was disseminated at rates of 12.5 or 25 pounds per mile. It was found that a clearing generally occurred in 30 to 45 minutes. The only real failure occurred in a case that may have been an ice fog; in addition, proper positioning

of the cleared hole proved a major problem throughout the program. Despite these difficulties, an estimated 200 successful takeoffs and landings were made using artificially produced clearings. Supplemental tests were carried out using airborne liquid CO₂ dispensers and silver iodide pyrotechnics.

AWS TR 206 (AD-671935) *Finite-Difference Methods Used in Models of the Atmospheric Boundary Layer*, by Maj. Lynn L. LeBlanc, June 1968, 18pp. Describes and comments on several finite-difference methods for solving equations considered in modeling the planetary boundary layer. Three implicit finite-difference schemes and one explicit scheme discussed, each is considered in view of required computer running time.

AWS TR 207 (AD-836556) *Proceedings of the Technical Exchange Conference, Fort Monmouth, N.J., 19 April-1 May 1968*, July 1968, 178pp. The collected summaries of 21 technical presentations and four speeches made at the AWS Technical Exchange Conference, 29 April-1 May 1968, held at Ft. Monmouth, N. J. Authors represented Army, Navy, and Air Force meteorological activities and their contractors, as well as ESSA, NASA, and NCAR. Contents:

"Atmospheric Influences Upon Military Operations," by K.M. Ramett, pp 4-13.

"Impact of the Aerospace Natural Environment on Air Force Operations," by Col. A.R. Hull, pp 14-18.

"The Impact of the Environment Upon Naval Operations," by Capt. W.L. Sommerville, Jr., pp 19-26.

"Atmospheric Observations and Related Techniques Development in the Air Force," by Capt. Serhij Pilipowskyj, pp 27-30.

"Navy Applications of METSAT Data," by Rolf M. Nilsestuen, pp 31-33.

"The Automated Meteorological System," by D.A. Deisinger, pp 34-40.

"Present and Future Status of ESSA Satellite Program," by Dr. C.A. Spohn, pp 41-44.

"Wind Measurements at Upper Levels by Means of LORAN-C Aids to Navigation," by C. Harmantas, pp 45.

AFWA Technical Reports

"Meteorological Research Satellites," by R.L. Houghten, pp 45-65.

"Visibility Measurements for Aviation Use," by E. Bromley, Jr., pp 66-72.

"Professionals in Military Meteorology," by Brig. Gen. R.K. Pierce, Jr., pp 73-74.

"Air Force Activities in Atmospheric Analysis and Prognosis," by Maj. J.S. Perry, pp 75-79.

"Thirty-Day Forecasts for Southeast Asia," by Lcdr. R.C. Corkrum and Lcdr. R.F. Alden, pp 80-87.

"Meteorological Research Through Analog Simulation at Texas A & M University," by Dr. W.H. Clayton, pp 88-97.

"The Forecasting Research Program of the Weather Bureau," by W.H. Klein, pp 98-117.

"Real-Data Forecasting with the NCAR General Circulation Model," by D.P. Baumhefner, pp 118-131.
"Select Products of the ESSA Weather Modification Program," by H.K. Weickmann, pp 132-151.

"Hail-Suppression Research at NCAR," by G.C. Goyer and M.N. Plooster, pp 152-155.

"The USAF Weather Modification Program," by Maj. T.A. Studer, pp 156-159.

"U.S. Navy Program in Weather Modification," read by Cdr. F.F. Duggan, Jr., pp 160-164.

"U.S. Army's Program in Weather Modification," by E.M. Frisby, pp 165-166.

AWS TR 208 (AD-671506) *Estimating Conditional Probability and Persistence*, by Col. John T. McCabe, June 1968, 23pp. Describes statistical model and automated techniques that provide estimates of conditional and persistence probability of meteorological events for periods to 48 and 24 hours, respectively. For use when conditional/persistence frequencies not obtainable by directly processing observational data. Model considers diurnal variability of event by assuming joint probability according to elliptical distributions defined by known (or estimated) hourly unconditional probabilities and lag correlation coefficients obtained

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from previously summarized data. A computer program performs integrations by transforming elliptical distributions to circular normal with rotated axes, then counts number of mil-frequency units in each of the joint probability zones. Comparison of conditional and persistence probability estimates of categorized cloud cover and ceiling/visibility events with observed frequencies of occurrence show root-mean-square differences of 5 to 15 percent.

AWS TR 209 (AD-680424) *Final Report on the Air Weather Service FY 1968 Weather Modification Program: Projects WARM FOG, COLD FOG III, COLD WAND, COLD HORN, AND COLD FAN*, November 1968, 54pp. Final reports on five separate fog-dispersion tests conducted by AWS during the winter of 1967-1968. One project (WARM FOG) involved fog temperatures above 32° F; four projects (COLD FOG III, COLD WAND, COLD HORN, and COLD FAN) dealt with supercooled fogs. Each project reported separately with conclusions and results summarized for all except Project COLD FOG III.

AWS TR 210 (AD-676295) *The Use of Trajectories in Terminal Forecasting*, August 1968, 57pp. The winter trajectory test program was conducted at part of the AWS forecaster assistance program. Objective was to determine if three-dimensional trajectories derived from the output of the AFGWC six-level forecast model are useful in preparation of terminal forecast. Hq AWS personnel used trajectory data to evaluate forecasts prepared at detachments in central and eastern United States and to modify some of these forecasts. Trajectory data improved the 4-month verification of terminal forecasts by 3.1 percent. Tests conducted in 1st Weather Wing and 2nd Weather Wing, results from these overseas tests discussed. Forecast procedures and application or objective rules developed during winter evaluation described in several case studies.

AWS TR 211 (AD-680425) *Objective Forecasting*, by P. Williams, Jr., 1968, and *Objective Forecast Studies and Their Evaluation and Verification*, by CMSgt. D.N. Seay, December 1968, 53pp. A reprint of two articles on "objective forecasting studies." The first reprinted from an August 1968 USWB Western Region report, the second from 7WW Technical Note No. 6, February 1967. Current ways to prepare and verify objective forecast studies by station forecasters are presented; a discussion on proper selection of predictors and uses in the studies is included. Samples of objective studies for

use with various forecast elements are outlined. AWS-TR-211/1A, June 1971.

AWS TR 212 (AD-786137) *Application of Meteorological Satellite Data in Analysis and Forecasting*, June 1969, 223pp. Also issued as ESSA Technical Report NESC 51, November 1971. Includes Supplement 1, November 1971, 70pp. Supplement 2, March 1973, 65pp. Report is a joint effort of the Applications Group, National Environmental Satellite Center (NESC), now the National Environmental Satellite Service (NESS); the Naval Air Systems Command Project FAMOS; and the Satellite Section, USAF Environmental Technical Applications Center (ETAC). Topics include: Satellite cloud atlas and glossary; synoptic cloud patterns; application of satellite data to synoptic analysis in the tropics; local phenomenal infrared.

AWS TR 213 (AD-691811) *The Air Weather Service Weather-Modification Program (FY 1969)*, by Herbert S. Appleman, June 1969, 18pp. In the second year of its full-scale weather-modification program, AWS carried out four supercooled-fog dissipation projects: two airborne and two ground-based. Airborne techniques using crushed dry ice and silver iodide fuses can now be considered fully operational, but testing will continue to optimize equipment and technique. The ground-based liquid-propane technique has justified an operational test program using a network of fixed propane dispensers. Results of the ground-based warm-fog dissipation test indicate that using sized sodium nitrate offers a solution.

AWS TR 214 (AD-726984) *Guide to Local Diffusion of Air Pollutants*, by Maj. Gordon A. Beals, May 1971, 86pp. A guide on local air pollution for forecasters with no prior experience in diffusion. Discusses fundamentals of micrometeorology and diffusion in the lower layers; their relation to determining air pollutant dispersion and concentration amounts is explained. Calculations of pollutant concentrations using accepted techniques are discussed; solution of actual air pollution problems shown in the appendix. Includes graphs and nomograms used in solving air pollution problems.

AWS TR 215, Vol. I (AD-711655) *Mean Cloudiness and Gradient-Level Wind Charts over the Tropics, Volume I, Text*, by Maj. Gary D. Atkinson and Professor James C. Sadler, August 1970, 25pp. Part A, monthly resultant gradient-level wind. Part B, average monthly cloudiness. Report describes method of construction and

use of a set of 48 climatological charts published separately as AWS TR 215, Vol II. Charts are for monthly resultant gradient-level wind and for monthly mean cloudiness, scale 1:20 million mercator. Volume I gives data source and description of main chart features, usefulness for training and briefing. Gradient-level chart used for synoptic analysis and forecasting in the tropics, but sparseness of data makes climatological charts of special value in analysis. Available climatological charts being inadequate, a new series was prepared. The mean cloudiness charts serve a similar purpose.

AWS TR 215, Vol II (AD-NONE) *Mean Cloudiness and Gradient-Level Wind Charts over the Tropics, Volume II, Charts*, by Maj. Gary D. Atkinson and Professor James C. Sadler, August 1970. Climatological charts for Volume I. Oversized (approx. 18" x 21"). Note: Not available from DTIC.

AWS TR 215, Vol III (AD-A123032) *Mean Surface Flow for Tropical Pacific*, by Professor James C. Sadler, October 1982, 26pp. A set of twelve monthly meteorological charts of mean global tropical wind fields for the Pacific. This revised data includes extensive ship data obtained from ship logs. Wind steadiness and velocity are given for each 2 1/2-degree grid points.

AWS TR 216 (AD-NONE) *List of Translations on Meteorology and Atmospheric Physics*, compiled by Rosa E. Hay. In three volumes:

- **Volume I**, (AD-227459) April 1959, 140 pp. Formerly AWS Bibliography 15, later redesignated AWSP 0-15, Vol I. In two parts. Lists all unclassified translations in the field of meteorology and related geophysical topics known to Hq AWS. List of classified translations issued separately as AWS Bibliography 16. AD-156857.

- **Volume II**, (AD-265052) 30 September 1961, 105pp. Formerly AWSP 0-15, Vol II; a continuation of AWS Bibliography 15.

- **Volume III**, (AD-284757) 30 July 1962, 50pp. Formerly AWSP 0-15, Vol III. A continuation of AWS Bibliography 15 and AWSP 0-15, Vol II.

AWS TR 217 (AD-862101) *Meteorological Resources and Capabilities in the '70s: Proceedings of the 5th AWS Technical Exchange Conference, Air Force Academy, 14-17 July 1969*, October 1969, 258pp. A collection of reports or summaries of 29 technical papers

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presented at the 5th AWS Technical Exchange Conference held at the USAF Academy 14-17 July 1969. General theme: "Meteorological Resources and Capabilities of the 1970s." Authors represented Air Force, Army, Navy, NASA, ESSA, USDA, NCAR, several universities, and an airline. Contents:

"Data Gathering Systems of the '70s—A Survey," by J. Giraytys, pp 5-31.

"Ground-Based Meteorological Observing Systems in the 1970s," by A.S. Carten, Jr., pp 32-48.

"Meteorological Reconnaissance Systems of the 1970s," by R.A. Chappell, pp 49-52.

"The Development of Meteorological Satellites in the United States and the Outlook for Future Sensing Systems," by W. Nordberg, pp 53-61.

"National Data Buoy Development Project, A Status Report," by Capt. J.A. Hodgman, pp 62-68.

"USAF Aerospace Environmental Data Communications in the '70s," by Maj. R.W. Fanning, pp 69-73.

"AFGWC Meteorological Display Techniques," by Lt. Col. Charles W. Cook, pp 74-83.

"The Navy Weather Research Facility Program for the Development of a Functional Display and Presentation System," by Earl C. Kindle, pp 84-97.

"On Limits in Computing Power," by W.H. Ware, pp 98-101.

"The Army's Automatic Meteorological System," by O.M. Swingle, pp 102-110.

"Luncheon Address," pp 111-114. "Problems and Promises of Deterministic Extended-Range Forecasting," by J. Smagorinsky, pp 115.

"Numerical Weather Prediction Capabilities in the 70s—A Personal View," by F.G. Shuman, pp 116-122.

"The Real-Data Forecast Project at NCAR—A Progress Report," by D.P. Baumhefner, pp 123-137.

"Progress Report on Atmospheric Predictability," by E.N. Lorenz, pp 138-143.

Chapter 2

"The Computer's Role in Weather Forecasting," by W.H. Klein, pp 144-153.

"The Role of the Man in Weather Forecasting," by J.J. George, pp 154-156.

"The Man-Machine Mix in Applied Weather Forecasting in the 1970s," by L.W. Snellman, pp 157-165.

"Survey of Progress and Plans in Tropical Meteorology Experiments," by Dr. E.J. Zipser, pp 178-188.

"Synoptic Analysis Models for the Tropics," by R.H. Simpson, pp 189-200.

"The Use of Satellite Data in the Tropics," by R.K. Anderson and V.J. Oliver, pp 201-208.

"Results and Plans of the AFCRL, University of Hawaii, 1WW Tropical Meteorological Research Program," by T.J. Keegan, pp 209-224.

"Air Weather Service and Weather Modification," by T.A. Studer, pp 225-227.

"Lightning Suppression," by D.M. Fuquay, pp 228-234.

"Hail Suppression in the Seventies," by G.G. Goyer, pp 235-243.

"Precipitation Augmentation," by P. Squires, pp 244-246.

AWS TR 218 (AD-698333) *Preparation of Terminal Forecast Worksheets*, October 1969, 10pp. Discusses importance of systematic procedures in preparation of terminal forecast. Use of a TAF worksheet is recommended and characteristics of a good worksheet are described. Sample worksheet included.

AWS TR 219 (AD-706392) *Forecasting Gusty Surface Winds in the Continental United States*, January 1970, 76pp. Contains case studies of strong surface wind gust occurrences under specific conditions in certain designated areas called "wind boxes." There are 10 such wind boxes within the contiguous United States. Actual cases are included, with several of the main weather charts used in forecasting gust occurrences. Procedures given are a relevant part of method used by the Military Weather Warning Center in forecasting gusty surface winds.

AWS TR 220 (AD-745098) *Aircraft Icing Climatology for the Northern Hemisphere*, by Maj. Edward D. Heath and SMSgt. Luther M. Cantrell, June 1972, 77pp. Update of AWS methodology used to determine climatological probability of aircraft icing throughout the Northern Hemisphere. Gives isopleth charts of the 1,000-, 850-, 700-, and 500-mb surfaces for each month. Station listing and locator chart give area coverage of data used in computer calculations. Prepared for AF Systems Command in response to request for information on aircraft icing probability from near surface to 40,000 feet.

AWS TR 221 (AD-729764) *A Study of Stratospheric Emitters Based on Infrared Radiometersonde Measurements*, by Maj. Serhij Pilipowskyj and Professor James A. Weinman, August 1971, 65pp. Analysis of downward-directed infrared irradiances measured in the lower stratosphere indicated that reasonable limits on the gaseous components of the atmosphere were not able to account for the irradiances observed between 14 and 24 km. Therefore, additional emitters were assumed to exist at these altitudes. Information on the spatial and temporal distributions of the stratospheric emitter from an analysis of some 400 measurements taken 1962-1967. Results indicate that while this is a global phenomenon, it is most evident in the tropics at altitudes between 15 and 18 km. Time series of daily radiometersonde ascents carried out during the Line Islands experiment indicated that the emitter has high persistence in the tropics. A series of synoptic-scale ascents made over the central United States one night indicated that the emitter has great variability in the midlatitudes. No long-term trends in the concentration of the emitter in the tropics or in the midlatitudes could be determined.

AWSTR 222 (AD-733338) *Comparative Meteorological Testing of the AMT-13 Dropsonde and JOOX-Series Rawinsonde in an Environmental Wind Tunnel*, by 1st Lt. B.P. Severin, August 1971, 89pp. Describes a test program conducted at the Arnold Engineering and Development Center (AEDC), Tullahoma, Tennessee. Test was to determine accuracy and response characteristics of temperature and relative humidity measurements made by AMT-13 Dropsonde and JOOX-Series Rawinsondes. Temperature measurements of both systems found to be accurate to within plus or minus 1.0 degrees Celsius and both would respond to temperature change rates equivalent to 5 degrees Celsius per 1,000 feet of vertical atmosphere

without significant loss of accuracy. Humidity measurements of both systems were within the specified plus or minus 5 percent to 7 percent relative humidity accuracy, but the AMT-13 dropsonde humidity accuracy degraded rapidly upon encountering liquid moisture. A shield to protect the dropsonde humidity sensor from direct moisture contact was fabricated and tested; it virtually eliminated the water-induced inaccuracies.

AWS TR 223 (AD-709364) *Operational Utilization of the AN/TPQ-11 Cloud Detection Radar*, June 1970, 59pp. A reprint of an AFCRL report by Wilbur H. Paulsen, Pio J. Petrocci, and George McLean. Fifty-three AN/TPQ-11 Cloud Detection Radars were procured for USAF use, most by AWS. Since these sets are capable of furnishing a great deal of meteorological data not otherwise available, AWS asked AFCRL to determine the effect of geographical and seasonal variations on AN/TPQ-11 observations. AN/TPQ-11 cloud height records at eight widely separated AF bases are analyzed for possible variations in interpretation that might be required as a function of location or environment. Modes of operation necessary to obtain useful records with maximum information are specified, and examples of records for various meteorological situations are shown. These records are analyzed, and a number of maintenance procedures are suggested to assist in obtaining high quality records.

AWS TR 224 (AD-730622) *Introduction to Lightning and Other Electrostatic Phenomena*, by Capt. Nixon A. Adams, August 1971, 54pp. Points out importance of understanding basic physical principles of the lightning stroke, the lightning flash, and certain other electrostatic phenomena. Several theories on creation of negative and positive charge centers in cumulonimbus clouds presented. Integral parts of a single lightning flash covered in detail.

AWS TR 225 (AD-NONE) *Use of Asynoptic Data in Analysis and Forecasting*, 11 March 1960, 27pp. Formerly AWSM 105-10. Suggests and illustrates ways to make optimum use of asynoptic weather reports. Applies to all AWS forecasting activities and serves as study material for in-station training and schools. Gives procedures for plotting, displaying, and analyzing reconnaissance data, AIREPS, upper air soundings, surface data. Applications in briefing, forecasting, and met watch discussed. Not available from DTIC—refer requests to AFWTL.

AWS TR 226 (AD-707118) *Introduction to Jet-Engine Exhaust and Trailing Vortex Wakes*, by Lt. Col. Dale N. Jones, April 1970, 34pp. A survey of available literature on aircraft wakes. While not the final word on the subject, the survey is a good general representation of techniques and problems.

AWS TR 227 (AD-117710) *Constant-Pressure Trajectories*, September 1956, 86pp. Reprinted to correct typos, 1958. Formerly AWSM 105-47. Published as an aid to constructing trajectories for constant-pressure balloon flights. Several current methods from usual upper-level, constant-pressure contour or flow charts are described. New "AWS Method" developed by Dr. Karl R. Johannessen, Hq AWS, is also presented. In two sections: operational and theoretical.

AWS TR 228 (AD-047587) *Forecasting Upper-Level Winds, Part One, Forecasting by Vorticity Techniques*, June 1954, 50pp. Formerly AWSM 105-50/1. Discusses use of absolute and relative vorticity in forecasting midtropospheric flow patterns for periods up to 72 hours. Early chapters on so-called Rossby waves, or long waves in the westerlies, supersede AWS TR 105-90.

AWS TR 229 (AD-117709) *Forecasting Upper-Level Winds, Part One, Forecasting by Vorticity Techniques, Appendix B: Vorticity—An Elementary Discussion of the Concept*, August 1956, 27pp. Formerly AWSM 105-50/1A. Provides a basic and elementary explanation of the vorticity concept.

AWS TR 230 (AD-717197) *Forecasting Upper-Level Winds, Part Two, Differential Analysis in the Troposphere*, August 1954, 51pp. Formerly AWSM 105-50/2; redesignated TR 230, May 1970. Change A added November 8, 1960. Prepared as a manual for forecasters in weather centrals. Describes manual techniques developed for analysis of constant-pressure charts in the troposphere by means of so-called thickness-analysis. Various tables and nomograms to facilitate the procedure are included.

AWS TR 231 (AD-283404) *Forecasting for Aerial Refueling Operations at Mid-Tropospheric Altitudes*, July 1957, 110pp. Formerly AWSM 105-52. Considers problem of forecasting clouds in the aerial refueling layer from 15,000 to 20,000 feet. Previous investigations of clouds at midtropospheric levels are reviewed. Preliminary charts of seasonal frequency of unsuitable

conditions for refueling in the 15,000- to 20,000-foot layer given for the Northern Hemisphere north of 20° N.

AWS TR 232 (AD-072927) *Meteorological Aspects of pressure Pattern Flight*, December 1954, 63pp. Formerly AWSM 345-1. A primer for pressure-pattern flight and night planning. Includes history, concept, basic principles for pressure-pattern flying. Comprehensive bibliography. Procedures are applicable to jet aircraft, but this phase of the subject still under investigation and development.

AWS TR 233 (AD-716391) *Some Techniques for Short-Range Terminal Forecasting*, September 1970, 51pp. Formerly AWSM 105-51/1. Describes several techniques for short-range terminal forecasting. Areas discussed are procedures for graphical extrapolation, nephanalysis, forecasting frontal precipitation, and lowering of ceilings during precipitation. Use of FPS-77 radar and weather satellite data also discussed.

AWS TR 234 (AD-873241) *A Model of Ionospheric Total Electron Content*, by Maj. Allan C. Ramsay, June 1970, 40pp. Presents a method for specifying or predicting the total electron content of an undisturbed midlatitude ionosphere during the maximum phase of the solar cycle. Report is operationally oriented: procedures are suitable for hand calculations and based on readily-available information. Diurnal, seasonal, and solar activity related variations in total electron content are modeled. This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with prior approval of Hq AWS.

AWS TR 235 (AD-074755) *Some Techniques for Deriving Objective Forecasting Aids and Methods*, April 1953, 51pp. Formerly AWSM 105-40. A guide for preparing forecast studies. Examples, references.

AWS TR 236 (AD-712392) *Air Weather Service Weather-Modification Program (FY 1970)*, by Herbert S. Appleman, August 1970, 18pp. Describes weather-modification (fog dissipation) projects undertaken by AWS during FY 1970. Gives techniques employed, equipment used, and project results. Not intended to provide technical details, but to inform AWS community of current AWS capabilities.

AWS TR 237 (AD-716811) *The Use of Trajectories in Terminal Forecasting (Second Report)*, by Capt. John W. Diercks, November 1970, 33pp. Trajectory forecasting techniques introduced at 75th AWS forecast units. Trajectory data, in form of parcel origins and forecast temperatures, dew points, and cloud amounts, transmitted twice daily to these units. Data is a by-products of the AFGWC multilevel cloud-forecasting model; used to supplement conventional forecast tools. In addition, 600-meter (AGL) temperature and dew-point forecasts from AFGWC's boundary-layer model are included in the trajectory bulletin. Trajectory techniques have been integrated subjectively and objectively into forecast procedures with encouraging results. Ceiling and visibility forecasts prepared with trajectory data have verified better than forecasts prepared without. This report discusses past evaluation programs, characteristics of the trajectory model, and procedures for using the data in forecast applications.

AWS TR 238 (AD-713636) *A Summary of Airline Weather-Radar Operational Policies and Procedures*, by Maj. Paul W. Kadlec, USAFR, September 1970, 21pp. Discusses and summarizes weather-radar operational policies and procedures of 11 U.S. airlines.

AWS TR 239 (AD-033689) *General Aspects of Fog and Stratus Forecasting*, April 1954, 99pp. Formerly AWSM 105-44. A brief review of the synoptic nature and causes of fog and stratus. Discussion expanded for each type of fog. Actual examples provided. Extensive annotated bibliography. There are two 2d Weather Wing Supplements to AWS-TR-239:

2WW Sup 1 (AD-064353) *Weather, General Aspects of Fog and Stratus Forecasting-Objective Visibility Study, Rhein Main Air Base, Germany*, 10 May 1954, 32pp.

2WW Sup 2 (AD-064354) *Weather, General Aspects of Fog and Stratus Forecasting—Application of the Rhein Main Visibility Study to an Operational Problem*, 10 May 1954, 32pp.

AWS TR 240 (AD-723392) *Forecasters' Guide to Tropical Meteorology*, by Maj. Gary D. Atkinson, 1 April 1971, 361pp. A practical manual for training and reference use in the tropics. Covers basic facts of climatology circulation, synoptic models, analysis, and forecasting applicable throughout the tropics. A broad survey is made of the literature and evaluated in light of

the author's experience. Physical factors controlling tropical circulations briefly discussed. Data sources for synoptic purposes reviewed. Climatology of pressure, winds, temperature, humidity, clouds, rainfall, and disturbances presented in a form specially suitable for forecasters. Analysis and forecasting of disturbances, cyclones, severe weather, terminal weather, etc., treated at length. Emphasis placed on uses of climatology and satellite cloud photos. Over 230 figures adapted from the literature or prepared by the author serve to illustrate essential facts and principles discussed. Summary of the state of art and future outlook of tropical meteorology included. Note: TR 240 has been superseded by AWS TR 95/001, updated by Dr. Colin Ramage.

AWS TR 241, VOL I (AD-721687) *The Practical Aspect of Tropical Meteorology*, October 1970, 212pp. Formerly AWSM 105-48, Volume 1. Report in seven parts. After short introduction, discusses ways tropical forecasters may use climatological information. Next section emphasizes that evaluation of tropical data is different from that which is standard in high latitude meteorology. Long discussion of wind analysis, using streamlines and isotachs. Fifth section covers methods of analyzing cloud and weather distribution in the tropics. Sixth section deals with problems of correlation of wind and weather patterns, of continuity, and with related topics. Material presented chiefly in form of practical examples. Finally, structure, genesis and movement of tropical cyclones are briefly discussed.

AWS TR 241, VOL II (AD-721688) *The Practical Aspect of Tropical Meteorology, Notes on the Tropical Pacific and Southeast Asia*, 26 January 1961, 184pp. Formerly AWSM 105-48, Volume II. Report designed to supplement other texts on tropical meteorology. Makes use of new observational material and accords synoptic features of monsoons more attention than they have received in the past. Hints on analysis and uses of auxiliary charts and continuity followed by chapter on physical geography of the Pacific and a gazetteer describing the locations and environments of observing stations. Chapter 3 tabulates monthly mean resultant winds, steadiness and other derived data at standard pressure levels for 34 sounding stations. Chapter 4, which broadly considers the climatology of the region, leads to more detailed discussions of the synoptic climatology of the tropospheric field of motion in the central pacific (Chapter 5) and of the synoptic climatology of the China seas and Southeast Asia

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(Chapter 6). Appendices amplify topics covered in this chapter. Final chapters devoted to tropical cloud physics, local effects, and aerial reconnaissance. Not available in paper—DTIC microfiche copies only.

AWS TR 242 (AD-724093) *Proceedings of the Automated Weather Support Technical Exchange Conference (6th) Held at the U.S. Naval Academy, Annapolis, Maryland, on 21-24 September 1970*, April 1971, 392pp. Contains reports presented at the Sixth Technical Exchange Conference sponsored by AWS.

"Evolutionary Changes in the NMC Primitive-Equation Model and Plans for Future Models," by J.D. Stackpole, pp 9-16.

"Fleet Numerical Weather Central's Four Processor Primitive-Equation Model," by P.G. Kesel and F.J. Winninghoff, pp 17-41.

"Spectral Models for Global Analysis and Forecasting," by Maj. T.W. Flattery, pp 42-54.

"Some Primitive-Equation Model Experiment for a Limited Region of the Tropics," by Professor K.L. Elsberry and Lcdr. E.J. Harrison, Jr., pp 55-71.

"AFGWC Boundary-Layer Model," by Lt. Col. Kenneth D. Hadeen, pp 72-97.

"Diagnoses and Prediction of Marine Boundary-Layer Mesoscale Wind Phenomena," by R.V. Cormier and Earl C. Kindle, pp 98-111.

"Predictability of Local Weather," by Charles F. Roberts, pp 112-123.

"Objective Meso-Scale Analysis of Upper-Air Winds in Southeast Asia," by Marvin J. Lowenthal, pp 124-129.

"The Development of Automated Short-Range Terminal Forecasting Using Analog Techniques," by Lt. C.D. Thormeyer, pp 130-150.

"Application of PE-Model Forecast Parameters to Local-Area Forecasting," by L.W. Snellman, pp 151-168.

"Preliminary Results of a Program for the Automation of Terminal Forecasts," by Harry R. Glahn and R.A. Allen, pp 169-176.

Chapter 2

"An Approach to Automated Support to Field Army Operations," by J.F. Appleby, pp 177-182.

"Numerical Products as Specific Operational Forecasting Aids," by Earl C. Kindle, R.L. Crisci, and Joseph T. Schaefer, pp 183-201.

"An Automated Program to Produce and Update Computer Flight Plans," by Capt. R.J. LaSure, pp 202-213.

"Meteorological Support to White Sands Missile Range," by H.M. Richart, pp 214-223.

"The Use of Computer Products in Severe-Weather Forecasting," by R.E. Miller and Lt. Col. Arthur Bidner, pp 224-228.

"The AFGWC Severe-Weather-Threat (SWEAT) Index (A Preliminary Report)," by Lt. Col. Arthur Bidner, pp 229-231.

"Processing of ITOS Scanning-Radiometer Data," by Charles L. Bristor, pp 232-242.

"Thoughts on the Second Decade of Navy Satellite-Data Application," by Cmdr. W. Ruggles, pp 243-247.

"Application of Satellite Data to an Automated Nephanalysis and Forecasting Program," by Maj. Ralph W. Collins and Maj. Allen R. Coburn, pp 248-260.

"The Application of the Nimbus Meteorological-Satellite Data," by Lewis J. Allison, pp 261-290.

"Automated Production of Global Cloud-Climatology Based on Satellite Data," by Maj. D.B. Miller, pp 291-306.

"Climate Modification and National Security," by R.R. Rapp, pp 307-310.

"Simulation of Ecological Systems," by A. Reddy, pp 311-322.

"Simulation of Weather-Sensitive Military Operations," by R.E. Huschke, pp 323-337.

"Environmental Simulation in Air-Pollution Control," by G.C. Holzworth, pp 338-348.

"Numerical Simulation of Hurricane Development and Structure," by S.L. Rosenthal, Richard A. Anthes, and J.W. Trout, pp 349-370.

AWS TR 243 (AD-NONE) *On the Use of Radar in Identifying Tornadoes and Severe Thunderstorms: A Diagnostic Guide for Radar-Scope Interpretation*, by Capt. Roger C. Whiton, May 1971, 19pp. With November 1971 change. Gives forecasters specific facts and figures useful in identifying severe weather echo signatures. All materials culled from professional literature—no new research presented. Superseded by AWS-TR-76-266.

AWS TR 244 (AD-743288) *Air Weather Service Weather-Modification Program (FY 1971)*, by Herbert S. Appleman, April 1972, 31pp. Annual report on AWS weather-modification activities. Discusses techniques, procedures, and results of projects COLD WAND, COLD FLAKE, COLD COWL, COLD CRYSTAL, WARM FOG, COLD RAIN during FY 1971. More details published elsewhere. Change 1, July 1972.

AWS TR 245 (AD-736004) *Project COLD RAIN*, by 1st Lt. Robert Sax and Capt. Ted S. Cress, December 1971, 51pp. Describes techniques and results of an AWS weather-modification operation aimed at augmenting rainfall in south-central Texas. The Air Force portion of the project (COLD RAIN) was conducted in June 1971 as part of a large Texas drought-relief program directed by the Bureau of Reclamation. The primary goal of the project was, by seeding super-cooled cumulus clouds with silver-iodide nucleating material, to increase rainfall (over what would have occurred naturally) in as wide a geographical area as possible. A secondary, but very important, consideration was to learn as much as possible about cloud response to seeding in order to refine and improve present-day rain-augmentation techniques.

AWS TR 246 (AD-763098) *Point Comparisons of Total Cloud Cover from Satellites and from Surface Observations*, by Maj. Patrick J. O'Reilly, April 1973, 58pp. Compares cloud-cover observations made by ground observers with relative cloud-cover estimates determined from satellite-measured brightness values. Comparisons made when each type of cloud (nine low type, nine middle type, and nine high type) are found alone, and also with various combinations of other clouds. More than 66,000 incidences are compared from observations taken over the China mainland and portions of Southeast Asia. Satellite observations from the ESSA and ITOS series of satellites used. Tabulated and

graphical results included, along with author's comments on investigative procedures and findings.

AWS TR 74-247 (AD-781837) *A History of Air Weather Service Weather Modification 1965-1973*, by Capt. Henry A. Chary, June 1974, 31pp. Starting in 1965 with cakes of dry ice suspended from balloons, then testing vented liquid carbon dioxide, vented liquid propane, and silver iodide, AWS gradually developed a ground-based cold fog dissipation system. Three such systems, all using vented propane, are now operational. In 1967, AWS undertook airborne dissipation of cold fog by seeding with crushed dry ice. AWS investigations into warm fog dissipation started in 1968 when jet engines were used to clear warm fog temporarily from the Travis AFB runway. Subsequently, several tests were run using hygroscopics and helicopter downwash. No operational warm fog dissipation system has yet evolved from these early works. Twice AWS has tried to alleviate the ice fog problem, but both tries failed to generate desired clearings. Precipitation augmentation for drought relief is a twice-used AWS capability. AWS has participated in such programs in the Philippines and in Texas. Current operational weather modification capabilities include airborne and ground-based cold fog dissipation and precipitation augmentation.

AWS-TR-248 (AD-742265) *Normalization Procedures for Sudden Phase Anomaly Events*, by Capt. William A. Wisdom, Jr., April 1972, 25pp. Discusses procedure whereby sudden phase anomalies (SPA) can be classified as major events, significant events, or minor events. Also, by determining the "path responsiveness" of a path at any given time, normalization factors can be applied to an observed event to determine its "absolute" importance, or its relative importance when compared to a standard event. Report contains procedures necessary to determine "path responsiveness" and normalization factors for any given VLF path. Standardized event categories established for operational use, and equations presented to define event categories on any SPA circuit.

AWS TR 249 (AD-755659) *Fifth Annual Survey Report on the Air Weather Service Weather Modification Program (FY 1912)*, by Herbert S. Appleman, et al., December 1972, 14pp. Covers FY 72nd AWS weather modification projects. Projects covered: COLD FLAKE, COLD WAND, COLD CLEAR, COOL VIEW, and the Elmendorf AFB ground-based propane system.

AWS TR 74-250 (AD-A007678) *Defense Meteorological Satellite Program (DMSP) User's Guide*, 1 December 1974, 120pp. Capabilities of the spacecraft, sensors, and data processor for the Defense Meteorological Satellite Program are described. Many meteorological and geophysical uses of this data are examined, and examples used to illustrate system capabilities to tailor imagery for large variety of present and future users.

AWS TR 73-251 (AD-770928) *Air Weather Service Weather Modification Program (FY 1973)*, by Capt. Henry A. Chary, et al., October 1973, 28pp. Annual report of AWS weather modification activities during FY 73. Projects discussed: COLD DRAFT, COLD FLAKE, COLD CLEAR, COLD SIGHT, and COLD DECK. An operation at Fairchild AFB, Wash., is mentioned.

AWS TR 75-252 (AD-A018989) *A Solar Optical Observer's Guide*, by SMSgt. Richard B. Agee, September 1975, 59pp. Describes the optical manifestations of certain types of solar activity. Intent is to assist observers, particularly inexperienced ones, in solar event detection and classification. Can serve as a quick reference in identifying solar phenomena.

AWS-TR-73-253 (AD-781053) *Verification of Rainfall Estimates: An Analysis of Activation Patterns of ADSID and ACOUSID Seismic and Acoustic Intrusion Sensors to Determine Rainfall Rates*, by Lt. Col. Donald H. Kampwerth and Capt. Richard Rasmussen, February 1974, 41pp. Test conducted at Eglin AFB, Fla., in fall 1972, to verify rainfall rates as determined from activation patterns of seismic and acoustic intrusion sensors. Sensor activations recorded, analyzed, and compared with rainfall rates determined from recording rain gauges collocated with sensor strings. Useful comparison data obtained in nine tests; definite sensor activation patterns correlated with various rainfall rates. Scatter diagrams prepared and analyzed to summarize sensor activation/rainfall rate comparison.

AWS TR 74-254 (AD-782704) *Seventh Annual Survey Report on the Air Weather Service Weather Modification Program*, by Capt. Henry A. Chary, et al., July 1974, 17pp. For the first time since AWS entered field of weather modification, no new projects were begun during FY 74. Three cold fog dissipation systems were used operationally (Fairchild, Elmendorf, and Hahn). These activities assisted 169 aircraft movements that would have been canceled,

delayed, or diverted. AWS continued active pursuit of a warm fog dissipation system for use at a few fog-plagued, high-traffic bases. Precipitation augmentation and severe storm mitigation received revived interest, but no operations or tests were carried out. Several important meetings of weather modification scientists are noted. Not registered at DTIC. Paper copies available from AFWTL.

AWS TR 75-255 The AWS Handbook of Ground-Based Cold Fog Dissipation Using Liquid Propane, in two volumes:

Volume I, *Theory and Practice* (AD-013797) by Capt. Henry A. Chary and Lt. Col. Ronald L. Lininger, July 1975, 62pp. Explains theory and practice of ground-based cold fog dissipation using vented liquid propane. Cumulative AWS experience in ground-based cold fog dissipation summarized. Three operational cold fog dissipation networks illustrated. General guidance for planning, procuring, installing, and operating dissipation systems given.

Volume II, *Hardwave* (AD-NONE) by 2d Lt. Russell M. Solt, July 1975, 38pp. A brief introduction to the AWS Cold Fog Dissipation program, followed by detailed plans and programs for the liquid propane dispensing systems at Elmendorf AFB, Alaska, and Hahn AB, Germany. Description of the automated radio-controlled system at Elmendorf is included. Note: Never published; draft manuscript file at AFWTL.

AWS TR 75-256 (AD-A008278) *Seasonal Effects on Sudden Phase Anomaly Normalization*, by Lt. Edward W. Cliver, January 1975, 29pp. The size of a sudden phase anomaly (SPA) corresponding to a given incident x-ray flux depends on the time of day of the event, the season, the length of the path considered, and the radiation spectrum. It is necessary to determine the influence of each factor if the measured phase advance is to serve as an accurate indicator of the size of the ionospheric disturbance or of the magnitude of the responsible solar flare. In this report, the effect of changing season is considered. For a given x-ray flux and solar zenith angle, the D-layer is more responsive in summer than in winter.

AWS TR 75-257 (AD-A013727) *Annual Survey Report on the Air Weather Service Modification Program (8th) (FY 1975)*, by Lt. Col. Ronald L. Lininger, July 1975, 8pp. AWS performed cold-fog seeding at three bases again during the winter of FY

1975. Results presented in terms of assisted landings or takeoffs. Cost/benefit figures cited, showing a total NE benefit of about \$98,000 for the three bases and for the season.

AWS TR-74-258 (AD-A015370) *Effect of Improved Accuracy of Aircraft Reconnaissance Data in the Initialization of a Two-Dimensional Hurricane Model*, November 1974, 49pp. Prepared by Richard A. Anthes and James E. Hoke as final report on USAF Contract F11612-74-90220. On the basis of a limited number of experiments, it appears that a significant improvement in a two-dimensional hurricane model's behavior results when the small errors associated with the proposed AWRS system are used instead of a system with temperature and wind errors about five times those of AWRS. Smaller errors associated with new AWRS much less damaging; observations appear to be accurate enough to provide reasonably useful numerical forecasts, at least with this model. Greatest effects of dynamic initialization, both positive and negative, occur when observations are added at the middle tropospheric level rather than the boundary layer. When the observations are added in the boundary layer alone, the model storm has not adjusted very closely to the observation after 12 hours of dynamic initialization and little difference between the two sets of observations exists after 24 hours of forecast time. In contrast, when observations are added to the middle tropospheric layer, they affect much more mass of the system and the hurricane adjusts much more rapidly. In this case, there is little imbalance after 12 hours of initialization and the differences in the model prediction persist for the duration of the forecast.

AWS TR 75-259 (AD-A047720) *Transnormalized Regression Probability*, by Capt. Albert R. Boehm, December 1976, 54pp. Incorporates July 1984 errata. The transnormalized regression probability (TRP) model uses climatological probabilities and requires only a relatively small database to calculate the probability of occurrence of a future weather event. The three main procedures that comprise this multivariate transnormalized method are transnormalization, correlation, and regression conditional probability. The transnormalization process, a nonlinear process, transforms the observed or raw data into the standard normal variable with the same cumulative climatological probability as the raw predictor. Transnormalization insures that the predictor is normally distributed. The correlation step involves finding the simple correlation between each pair of transnormalized variables. The

regression coefficients are calculated using the same steps involved in ordinary multiple linear regression. Conditional probability is calculated using transnormalized variables in the multivariate normal distribution.

AWS TR 75-260 (AD-A026302) *A Background Report on Total Electron Content Measurement*, by SMSgt. Edward D. Beard, December 1975, 30pp. A simple presentation of ionospheric characteristics, including the D-, E-, and F-regions, is followed by a general description of electromagnetic waves. One of the more important effects of ionospheric interactions with very high frequency (VHF) and ultra high frequency (UHF) radio waves used in modern electronic detection and tracking systems is refraction. Total electron content (TEC) measurements over specific locations are used as data inputs to numerical models of the ionosphere. Included: basic considerations for measuring TEC of the ionosphere using Faraday technique and group-path-delay technique, along with discussion of TEC variation.

AWS TR 76-261 (AD-A056159) *NCAR Sonde Flight Test Report*, by Capt. T. Earl Ley and Maj. E.J. Heald, January 1976, 34pp. Documents an operational test of the National Center for Atmospheric Research (NCAR) wind-finding dropsonde. Testing, conducted over the Pacific Ocean about 30 miles from Vandenberg AFB, took place on 11-12 December 1974. Object of the test was to determine ability of the dropsonde to measure stable atmospheric pressure, temperature, and humidity.

AWS TR 76-262 (AD-A026303) *Development/Decay Potential of Active Solar Regions from a Full-Disk Neutral-Line Analysis*, by TSgt. Jerry D. Farley, April 1976, 26pp. Discusses a full-disk neutral-line analysis technique and the relationship of solar active regions to the large-scale magnetic features. A classification of basic configurations and variations on these configurations are developed to aid in prediction of development/decay of active solar regions. Examples of these configurations presented and discussed in terms of evolution of actual disk regions.

AWS TR 76-263 (AD-A036493) *Stochastic Models for Deriving Instantaneous Precipitation Rate Distributions*, by Allen R. Davis and Capt. Daniel J. McMorro, July 1976, 25pp. One- and four-minute precipitation rate records are used to develop stochastic model relations between clock hours and 1-minute (or 4-minute) precipitation rate distributions. These models

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(for 13 locations) can be used to estimate annual and seasonal distributions of instantaneous precipitation rates for places where clock-hour rate distributions are known.

AWS TR 76-264 (AD-A067090) *Satellite Meteorology*, by Lt. Col. Henry W. Brandli, August 1976, 203pp. Describes types of U.S. meteorological satellites in operational use. Using examples of satellite imagery in the visible and infrared spectrums, the report shows how to identify various meteorological phenomena and various cloud types.

AWS TR 76-265 Not Used.

AWS TR 76-266 (AD-A048414) *Radarscope Interpretation: Severe Thunderstorms and Tornadoes*, by Capt. Roger C. Whitten and Maj. Robert E. Hamilton, September 1976, 29pp. Contains material taken from the available literature on identifying severe thunderstorms, hail, and tornadoes from radar echoes. Radar echo signatures indicating severe weather are consolidated for geographical areas and weather types to give radar meteorologists easy access to the findings of several investigators in the weather radar field. Information concerning x-band, s-band, and c-band radars included. Supersedes AWS-TR-243.

AWS TR 77-267 (AD-A052579) *Guide for Applied Climatology*, November 1977, 156pp. A useful guide to some applied climatological practices used by AWS meteorologists in support of military planning and operations. Explains application of statistics and probability techniques to climatological problem-solving, and provides several examples of methods useful in solving recurring requests.

AWS TR 77-268 Not used.

AWS TR 77-269 Not used.

AWS TR 77-270 Not used.

AWS TR 77-271 (AD-A099510) *New Severe Thunderstorm Radar Identification Techniques and Warning Criteria*, by Leslie R. Lemon, November 1977, 67pp. Also published as NOAA TM NWS NSSFC-1. Improved understanding of severe thunderstorm structure and evolution is used to develop new radar sampling techniques and warning criteria. The only radar data needed is obtained from conventional NWS radars (WSR-57, WSR-74C and S) when in PPI tilt sequence

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mode displaying video integrated and processed reflectivities. WSR-57 data for six storms is used to exemplify techniques and criteria.

AWS TR 77-272 Not used.

AWS TR 77-273 (AD-A050035) *Selected Topics in Statistical Meteorology*, edited by Robert G. Miller, July 1977, 172pp. A compilation of nine papers on statistical meteorology resulting from a graduate course at St. Louis University on special topics in statistical meteorology. Methodologies covered include the following: preliminary mathematics, screening regression, multiple discriminant analysis, regression estimation of event probabilities, canonical correction application, Markov processes, nonlinear prediction, Delphi technique, and the results of a single station forecasting experiment. Numerous examples included. Appendices discuss computer programs on screening predictors, Crout matrix operations, and REEP.

AWS TR 79/001 (AD-A070009) *Proceedings of the 8th Technical Exchange Conference, Air Force Academy, Colorado, 28 November-1 December 1978*, May 1979, 271pp. Full length or abbreviated reports of 48 presentations made at the Eighth Technical Exchange Conference, held at the USAF Academy, 28 November through 1 December 1978. Contents:

"Joint Doppler Operational Project," by K.M. Glover, R.J. Donaldson, Jr., K.E. Wikl, and Donald W. Burgess, pp 3-14.

"Technology Transfer in PROFS," by D.W. Beran and C.G. Little, pp 15-19.

"The Status and Prospectus of Planned Weather Modification: 1978," by S.A. Changnon, Jr., pp 20-27.

"GATE Research Results," (abstract) by E.J. Zipser, pp 28.

"A Review of Global Numerical Weather Prediction," by T.E. Rosmond, pp 29-37.

"Solar/Terrestrial Meteorological Relationships," by J.M. Wilcox, pp 38-45.

"Severe Weather Forecasting," (abstract) by Fredrick P. Ostby, pp 46.

"Probability Forecasting," by A.H. Murphy, pp 47.

"Applications of Tropical Cyclone Models," by K.L. Elsberry, pp 48-61.

"Recent Developments in Automated Weather Observing and Forecasting," by D.A. Chisholm, pp 62-68.

"Aviation Automated Weather Observation System Test Results and Automated Low-Cost Weather Observation System Development Status," by J.T. Briadley and D.W. Downen, pp 69-75.

"The Automated Meteorological Station. AN/TMQ-20," by W.J. Vendone, pp 76-77.

"Portable Automated Mesonet," by F.V. Brock, pp 78.

"A Laser Weather Identifier System," by M.J. Sanders, Jr., pp 79-86.

"Microprocessors in Weather Data Acquisition," by J.A. Cunningham, pp 87-90.

"Ground-Based Remote Sensing of Atmospheric Profiles," by M.T. Decker, E.E. Gossard, and E.R. Westwater, pp 91-92.

"Status of the National Weather Service Automation of Field Operations and Services Program," by R.G. Mcarew, pp 93-95.

"Operating with NEDS," by T.M. Piwowar, pp 96.

"Automation of a Convective Rainfall Estimation Technique Using Geosynchronous Satellite Data," by B.T. Miers, pp 97-104.

"Automated Cloud-Tracking Using GOES Imagery," by Roland E. Nagle and D.H. Lee, pp 105-111.

"Automated Short-Range Forecasting of Cloud Cover and Precipitation Using Geo-Stationary Satellite Imagery Data," by H.S. Muench and T.J. Keegan, pp 113-117.

"Use of the Nimbus-G Multi-Channel Microwave Radiometer to Deduce Atmospheric Properties," by Richard C. Savage and C.D. Hall, pp 118-122.

"Testing of Satellite Uplinked Remote Surface Weather Stations in the Siena Nevada," by D. Rottner and G.R. Price, pp 123-126.

"The Switch to a Climatic Perspective," by F.K. Hare, pp 127-128.

"Atmospheric Propagation Modeling and Measurement," by R.A. McClatchey, pp 129-137.

"Electromagnetic Propagation Assessment," by J.H. Richter, H.V. Hitney, Harry G. Hughes, and R.B. Rose, pp 138-147.

"The Electrooptical Sensor Atmospheric Effects Library," by L.D. Duncan, pp 148-153.

"A Comparison of the AFGL FLASH, DRAPER DART, and AWS Haze Models with the RAND WETTA Model for Calculating Atmospheric Contrast Reduction," by Dr. Partick J. Breitling, pp 154-162.

"Response Characteristics of Knollenberg Light-Scattering Aerosol Counters," by R.G. Pinnick and H.J. Auvermann, pp 163-173.

"Sensitivity Analysis and Parameterization of IR Contrast Transmission," by Maj. K.P. Freeman, pp 174-178.

"In Situ Measurements of Gaseous and Aerosol Absorption," by Y.P. Yee, C.W. Bruch, J. Corriveau, R.G. Pinnick, and R.J. Brewer, pp 179-186.

"General Circulation Models, Sea-Surface Temperatures, and Short-Term Climate Prediction," by D.L. Gilman, pp 187-192.

"Climatic Models for Planning and Supporting Weather Sensitive Operations," by Donald E. Martin, pp 193-201.

"Development of an Electro-Optical Parameter Climatology," by A. Ooroch and B. Katz, pp 202-206.

"Estimating the Probability of Cloud-Free Fields-of-View between Earth and Airborne/Space Platforms," by D.D. Grantham, I.A. Lund, and R.E. Davis, pp 207-214.

"Wind Profile Models (Surface to 25 Km) in Various Climatic Zones," by O.M. Essenwanger, pp 215-223.

"Development of Single Station and Area Statistical Short-Range Forecast Techniques," by Capt. M.J. Kelly, pp 224-226.

"The Tropical Cyclone Strike Probability Program," by S. Brand, pp 227-235.

"Field Artillery Meteorological Acquisition System," by R.L. Kobbiani, pp 236-239.

"A Real-Time Interactive Satellite Data Processing and Display System," by Lt. L.C. Rawlinson, pp 240-245.

"A Model for Producing Climatological and Real-Time Predictions of Clear Line-of-Sight for TV Precision Guided Munitions," by Maj. Laurence D. Mendenhall, Maj. J.D. Mills, Capt. D.F. Wooley, Dr. Partick J. Breitling, and Maj. P.H. Neu, pp 246-249.

"Micrometeorological Measurement Program in Support of High Energy Laser Facilities at White Sands Missile Range," by G. Hoidale, E. Fawbush, K. Kunkel, and D. McCullough, pp 250-254.

"Optimum Path Aircraft Routing System," by W.G. Schramm, pp 255.

"The Determination of Vehicle Flight Environment for Reentry Analysis Studies," by R.O. Olden, B.W. Kennedy, E.T. Fletcher, and T. Hanrahan, pp 256-260.

AWS TR-79/002 (AD-A075168) *Electro-Optical Handbook, Volume I—Weather Support for Precision Guided Munitions*, by Maj. Kit Cottrell, Lt. Col. Paul D. Try, Lt. Col. Donald B. Hodges, and Lt. Col. Ronald F. Wachtman, May 1979, 108pp. A foundation for weather support to precision guided munitions (PGMS) operating at visual through microwave wavelengths, for use by AWS forecasters and staff weather officers. Chapter 1 describes effects of the atmosphere and the earth's surface on electromagnetic energy. PGMS and their sensitivities to the environment discussed in Chapter 2. The next two chapters discuss PGM weather support concepts and techniques. Glossary of terms, supplemental radiative transfer theory, and example worksheets illustrating support techniques to TV, infrared, and laser designator systems included in appendices.

AWS TR-79/003 (AD-099155) *Cloud Patterns and the Upper-Air Wind Field*, by Roger Weldon, October 1979, 102pp. Information in this report derived empirically from study of SMS-GOES satellite imagery and atmospheric data, analyses, and progs distributed by National Weather Service. Text provides simple

comparisons of satellite observed cloud patterns and the wind field.

AWS TR-79/004 (AD-A078858) *An Investigation of Radar Returns and Their Relationship to Severe Weather Occurrences*, by Capt. Werner H. Balsterholt, November 1979, 99pp. FPS-77 5.4-cm radar information gathered throughout the United States, geographically and temporally separated to delineate severe from non-severe thunderstorms. The critical success indicator used to determine relative reliability of various radar signatures investigated. Thunderstorm structure reviewed, and evolution and development of severe storms is discussed. Severe storm environments analyzed, related to well-established severe storm criteria. The 30 dbz heights, when correlated with tropopause height or height of the total storm, are excellent signatures that frequently define thunderstorms likely to be associated with severe weather. Note: Available in DTIC microfiche only.

AWS TR-79/005 (AD-A098599) *Forecasting Altimeter Settings*, December 1979, 39pp. Formerly AWSM 105-54. Discusses four methods for converting a forecast sea-level pressure to a forecast altimeter setting. The first method (shortest and easiest to use) gives acceptable accuracy at most stations below 1,000 feet elevation and at many stations above 1,000 feet. The second method is more general and designed primarily for use at stations above 1,000 feet when large pressure and/or temperature changes are expected during the forecast period. Both methods require concurrent values of sea-level pressure and altimeter setting at the station in question. A third method is useful when concurrent values of sea-level pressure and altimeter setting are not available; it may be used at any elevation. The fourth method lets forecasters convert a forecast altimeter setting at one station to one for another station. Step-by-step procedures outlined for each method. Nomograms and table (Appendix A) included. Theoretical discussion of basis for all four methods given in Appendix B.

AWS TR-79/006 (AD-A221842) *Use of the Skew T, Log P Diagram in Analysis and Forecasting*, December 1979 (Revised March 1990), 153pp. Formerly AWSM 105-124 (ATI-169015). Describes the DoD Skew T, Log P diagram and provides instructions for its use, includes the following: how to plot the data on the diagram, how to determine unreported meteorological quantities and atmospheric stability from the data, how to analyze discontinuities, stable layers, and clouds, and how to use the plotted diagram

to help forecast elements such as aircraft icing and severe convective storms. First revised in November 1987 to update references, provide instructions for use of pressure-altitude curve and stability indices. March 1990 revision adds new stability indices and forecasting techniques displayed on the Satellite Data Handling System (SDHS), the Automated Weather Distribution System (AWDS), and microcomputer Skew T programs. Includes August 1988 and March 1989 errata sheet.

AWS TR-80/001 (AD-A085490) *Forecasters' Guide on Aircraft Icing*, March 1980, 61pp. A reprint of AWSM 105-39, January 1969, incorporating changes 1-3. Includes other changes, corrections to original. Provides guidance on aircraft icing for use in forecasting and flight briefing. Describes atmospheric conditions favorable for aircraft icing, also how different aircraft types affect potential for icing.

AWS TR-80/002 (AD-A097018) *The WC-130 Meteorological System and Its Utilization in Operational Weather Reconnaissance*, by Capt. Rodney S. Henderson, August 1980, 79pp. Discusses the USAF WC-130 weather reconnaissance system. Starts with a brief history of weather reconnaissance, then describes the WC-130. Includes descriptions of instrumentation used and discusses data dissemination, quality control, applications of weather reconnaissance to monitoring tropical cyclones, and conducting weather modification.

AWS TR-80/003 (AD-A221955) *Calculating Toxic Corridors*, by Capt. Jon P. Kahler, Lt. Col. Robert G. Curry, and Maj. Raymond A. Kandler, November 1980, 103pp. Revised April 1989 to incorporate revised Tables 2, 16, 22, 23, 24, and 32. Gives method of defining evacuation areas for accidental spills of toxic chemicals. An empirical diffusion equation is used to calculate the downwind hazard distance. The width of the toxic corridor, specified in angular degrees centered along the mean wind direction, is based on variability or wind direction. Choice of four methods involving tables, nomograms, and a programmable calculator is provided. Appendices give worksheets, example problems, procedures for determining meteorological inputs, a procedure for determining evaporative source strength, and more.

AWS TR-81/001 (AD-A111876) *Forecasting Aircraft Condensation Trails*, September 1981, 25pp. Formerly AWSM 105-100. Aircraft condensation trails (contrails)

are caused by aircraft aerodynamics or engine exhaust under proper atmospheric conditions. Engine-exhaust trails are the most common and are discussed in this report. Jet aircraft contrail-formation graphs facilitate yes-or-no forecasts for any season with forecasts of pressure, temperature, and relative humidity. Contrail probability curves give contrail probabilities with forecast pressure and temperature. Engine power setting does not affect contrail formation, but does affect contrail intensity. The contrail-formation graph for propeller aircraft is similar to the jet graph.

AWS/TR-83/001 (AD-A148894) *Equations and Algorithms for Meteorological Applications in Air Weather Service*, by Lt. Col. George E. Duffield and Maj. Gregory D. Nastrom, December 1983, 69pp. Lists equations or algorithms used in computing common meteorological and geophysical variables. Should serve as a handy reference for BWS computer programmers, promote standardization, and minimize time-consuming literature searches. Equations and algorithms classified in three groups: kinematic properties, thermodynamic properties, and gridded or contoured data fields.

AWS TR-83/002, Vol I (AD-A141227) *Mean Upper-Tropospheric Wind Flow for the Global Tropics*, by James C. Sadler, University of Hawaii, and Maj. Thomas C. Wann, Hq AWS, January 1984. Volume I provides a brief discussion of how the charts in volume II were developed; also describes significant climatological features. Report is a powerful forecast tool for tropical forecasters in its presentation of key synoptic features, their persistence, and their effects on sensible weather.

AWS/TR-83/002, Vol II (AD-A141484) *Mean Upper-Tropospheric Flow Over the Global Tropics*, by James C. Sadler, University of Hawaii, and Maj. Thomas C. Wann, Hq AWS, January 1984, 16pp. Contains mean monthly 200- and 300-mb charts discussed in Volume I. Charts in two colors, oversized (about 17" x 38").

AWS/TR-89/001 (AD-A227122) *Climatic Study of the Upper Atmosphere, Volume 1, January*, July 1989, 236pp. A study of the upper atmosphere based on 1980-1985 twice-daily gridded analyses produced by the European Centre for Medium Range Weather Forecasters. Included are global analyses of (1) Mean temperature/standard deviation, (2) Mean geopotential height/standard deviation, (3) Mean density standard deviation, (4) Height and vector standard deviation--all

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for 13 levels: 1,000, 850, 700, 500, 300, 250, 200, 150, 100, 75, 50, and 30 mb. Also included: mean dew point/standard deviation for levels from 1,000 through 300 mb; jet stream (mean scalar speed) for levels from 500 through 300 mb; global 5-degree grid point wind roses for all 13 pressure levels. A joint Navy/USAF document, also published as NAVAIR 50-1C-2.

AWS/TR-89/002 (AD-A227123) *Climatic Study of the Upper Atmosphere, Volume 2, February*, September 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR 50-1C-2.

AWS/TR-89/003 (AD-A227124) *Climatic Study of the Upper Atmosphere, Volume 3, March*, November 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-3.

AWS/TR-89/004 (AD-A227125) *Climatic Study of the Upper Atmosphere, Volume 4, April*, July 1989, 236pp. Abstract same Volume 1, Also published as NAVAIR50-1C-4.

AWS/TR-89/005 (AD-A232977) *Climatic Study of the Upper Atmosphere, Volume 5, May*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-5.

AWS/TR-89/006 (AD-A232978) *Climatic Study of the Upper Atmosphere, Volume 6, June*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-6.

AWS/TR-89/007 (AD-A227126) *Climatic Study of the Upper Atmosphere, Volume 7, July*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-7.

AWS/TR-89/008 (AD-A232979) *Climatic Study of the Upper Atmosphere, Volume 8, August*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-8.

AWS/TR-89/009 (AD-A232980) *Climatic Study of the Upper Atmosphere, Volume 9, September*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-9.

AWS/TR-89/010 (AD-A227127) *Climatic Study of the Upper Atmosphere, Volume 10, October*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-10.

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AWS/TR-89/011 (AD-A232981) *Climatic Study of the Upper Atmosphere, Volume 11, November*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-11.

AWS/TR-89/012 (AD-A232982) *Climatic Study of the Upper Atmosphere, Volume 12, December*, July 1989, 236pp. Abstract same as Volume 1. Also published as NAVAIR50-1C-12.

AWS/TR-90/001 (AD-231567) *Convective Scale Dynamics*, by Capt. Jeffrey R. Hedges, December 1990, 41pp. A simplified discussion of the convective process, the thunderstorm, and severe weather. Includes explanations of stability and the parcel theory. Describes thunderstorms from "garden variety" to supercell. Tells how to recognize and forecast severe weather. Abbreviates and summarizes Doswell (1992 and 1985).

AWS/TR-91/001 (AD-A254216) *Probability Forecasting: A Guide for Forecasters and Staff Weather Officers, December 1991, 124pp*. Formerly AWSP 105-51, 31 October 1978--includes Change 1, 16 October 1989. Describes recommended techniques for producing and evaluating probability forecasts. Includes a selected number of applications for optimal decision-making. Chapters 1-4 address specific needs of forecasters and supervisors who make and evaluate subjective probability forecasts. Chapters 5-7 address applications of probabilities in decision-making, primarily for staff weather officers and staffinets.

AWS/TR-93/001 (AD-A269686) *New Techniques for Contrail Forecasting*, by Capt. Jeffrey L. Peters, August 1993, 35pp. Documents the results of a study requested by the Strategic Air Command Deputy Chief of Staff for Operations (SAC/DO) to update previous contrail forecasting research done by Herbert S. Appleman for Hq Air Weather Service in 1953. Advancements in aircraft power plants, especially the development of bypass turbofan engines, made the new study necessary. This report describes the development of new contrail forecast algorithms for several types of engines used in high-flying aircraft. It also provides contrail forecasting rules that correlate synoptic-scale upward vertical motion with contrail formation. The results indicate significant improvement in contrail forecasting accuracy over the Appleman technique now in use at the Air Force Global Weather Central.

AWS/TR—95/001 (AD-A302314) *Forecasters Guide to Tropical Meteorology—AWS TR 240 Updated*, by Dr. Colin Ramage. AWS TR 240, by Maj. Gary D. Atkinson, has served as the reference manual for USAF weather forecasting in the tropics since it was published in 1971. Although TR-240 has endured for the past 25 years, Hq Air Weather Service recognized the need for an update and contracted with tropical forecasting authority Dr. Ramage to produce one. Although a great deal of new material has been added to reflect new techniques and new technology, it still covers the basic facts of climatology, circulation, and synoptic models, with emphasis on analysis and forecasting techniques for the tropics. Physical factors that control tropical circulations are discussed briefly. The climatologies of pressure, winds, temperature, humidity, clouds, rainfall, and

disturbances are presented in a form especially suitable for forecasters. Analysis and forecasting of disturbances, cyclones, severe weather, terminal weather, etc., are treated at length. The use of climatology and the interpretation and use of weather satellite imagery are emphasized. Numerous figures, adapted from the literature or prepared by the author, illustrate all the essential facts and principles discussed. A summary of the state of the art and future outlook for tropical meteorology is included, along with an extensive bibliography.

AFWA/TR-97/001 *Preparation of Terminal Aerodrome Forecast Worksheets*. This is an update of AWS/TR-218.

CROSS-REFERENCE LIST**AWS Manual/Pamphlet to AWS Technical Report**

For permanence, a few early AWS manuals and pamphlets were later converted to and republished as AWS technical reports. To facilitate reference, a list of known conversions follows:

<u>AWSM/P</u>	<u>Title</u>	<u>Converted to:</u>
AWSP 0-1	List of Meteorological Research Papers (M.R.P.S) of the British Air Ministry Meteorological Research Committee 1949-1958, Released to U.S. Defense Activities	AWS TR 156
AWSP 0-13	Catalog of Local Forecast Studies	AWS/TI-79/002
AWSP 0-14	Bibliography on Small-Scale Time and Space Variations in the Free Atmosphere	AWS TR 160
AWSP 0-15	List of Translations on Meteorology and Atmospheric Physics	AWS-TR-216
AWSP 0-17/1	Technical Publications and Documents of Air Weather Service Field Activities, Part One: 1945-61	AWS TR 173
AWSP 0-17/2	Technical Publications and Documents of Air Corps and AAF Field Weather Activities, Part Two: 1937-45	AWS TR 174
AWSP 0-18/2	Bibliography of Documents Prepared by Weather Staff Sections of Headquarters Army Air Corps and Headquarters Army Air Forces, 1937-June 1945	AWS TR 166
AWSP 105-2	Guide for Applied Climatology	AWS-TR-267
AWSM 105-10	Use of Asynoptic Data in Analysis and Forecasting	AWS-TR-225
AWSM 105-39	Forecasting Aircraft Icing	AWS/TR-80/001
AWSM 105-40	Some Techniques for Deriving Objective Forecasting Aids and Methods	AWS-TR-235
AWSM 105-44	General Aspects of Fog and Stratus Forecasting	AWS-TR-239
AWSM 105-47	Constant Pressure Trajectories	AWS-TR-227
AWSM 105-48	The Practical Aspect of Tropical Meteorology	AWS-TR-241

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AWSM 105-50/1	Forecasting Upper-Level Winds, Part I: Forecasting by Vorticity Techniques	AWS-TR-228
AWSM 105-50/1A	Appendix B: Vorticity—An Elementary Discussion	AWS-TR-229
AWSM 105-50/2	Forecasting Upper-Level Winds, Part 2: Differential Analysis in the Troposphere	AWS-TR-230
AWSM 105-51/1	Terminal Forecasting, Part 1: Extrapolation Techniques for Short-Period Terminal Forecasting	AWS-TR-233
AWSM 105-52	Forecasting for Aerial Refueling Operations at Mid-Tropospheric Altitudes	AWS-TR-231
AWSM 105-100	Forecasting Aircraft Contrails	AWS/TR-81/001
AWSM 105-124	SKEW-T Log P Diagram	AWS/TR-79/006
AWSM 345-1	Meteorological Aspects of Pressure-Pattern Flight	AWS-TR-232

Chapter 3

TECHNICAL NOTES

3-1. AFWA TECHNICAL NOTES. The OPR for AWS/AFWA technical notes is AFWA/DNT, 106 Peacekeeper Dr., 2N3, Offutt AFB NE 68113-4039. USAF units order by technical note number, AD number, and title from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019.

AWS/TN-78-001 (AD-A175202) *Southern Airways Flight 242: The Role of Airborne Weather Radar*, by Capt. James I. Metcalf, USAFR, November 1978, 7pp. Meteorological radar data was analyzed to determine the basis of the pilot's decision to penetrate a severe thunderstorm. The display of 3-cm reflectivity shows a maximum significantly less than that observed by National Weather Service radar but strong enough to have been contoured by airborne radar. The flight path through the storm suggests either a malfunction of the contouring or misinterpretation of the display by the pilots. This case illustrates danger of using 3-cm radar for storm penetration and the value of using current data from longer wavelength radars as aids to interpreting onboard radar displays.

AWS/TN-79/001, VOL I (AD-A072078) *Spectral Radiometric Measurement and Analysis Program, Volume I, Description of Mobile Radiometric Laboratory System*, by Lawrence G. Christensen, et al., Eastman Kodak Co., April 1979, 98pp. A report on a USAF Air Weather Service contract for research in the transfer of atmospheric energy in the visible and near-infrared portions of the electromagnetic spectrum. Objective was to produce a spectral model of path transmittance, radiance, and ground-level irradiance that could be related to weather observations through simultaneous, in-situ data collections. Instrumentation developed under subcontract to Eastman Kodak by Albuquerque Division of EG and G used in a 14-month collection program. A self-sustaining mobile field radiometric laboratory that contained custom-designed spectroradiometers, mechanical/electrical servo controls, and computer interfaces was used. With minicomputers and peripherals, the laboratory produced data processed later on larger systems. Volume I describes the mobile laboratory, radiometer calibration, and computer software. System documentation listed in appendix A.

AWS/TN-79/001, VOL II (AD-A072079) *Spectral Radiometric Measurement and Analysis Program,*

Volume II, Description of the Data Collection Program, by Lawrence G. Christensen, et al., Eastman Kodak Co., April 1978, 164pp. Volume II describes design of data collection program in the field, ranges of important experimental variables, measurements and supportive observations, and analytical software developed to perform analyses of resulting data.

AWS/TN-79/001, VOL III (AD-A072080) *Spectral Radiometric Measurement and Analysis Program, Volume III, Data Analysis and Formulation of the Model*, by Lawrence G. Christensen, et al., Eastman Kodak Co., April 1979, 224pp. Volume III describes the analysis used to reduce collected radiometric and meteorological data to a series of equations that became the SCAT3. Model based on physical equations for a homogeneous atmosphere, modified by empirical observations. With the model it is possible to estimate visible and near-infrared spectral absorption and scattering phenomena that result from atmospheric constituents of surface weather observations.

AWS/TN-79/001, VOL IV (AD-A072081) *Spectral Radiometric Measurement and Analysis Program, Volume IV, SCAT3 Operator's Manual*, by Lawrence G. Christensen, et al., Eastman Kodak Co., April 1979, 57pp. The model described in previous volumes was coded into a computer program called SCAT3. Volume IV acquaints the user with proper input sequences and options when SCAT3 is run on an IBM 370 computer.

AWS/TN-79/002 (AD-A167991) *Forecast Reviews and Case Studies*, by Col. Kenneth E. German, May 1979, 35pp. Discusses forecast "bust" reviews, provides examples for use by forecasters who want ideas for documenting their own forecast review programs.

AWS/TN-79/003 (AD-A167989) *Satellite Applications Information Notes, October 1975 - December 1978*, prepared by NESS and NWS, August 1979, 299pp. A complete collection of Satellite Applications Information

Notes published by National Environmental Satellite Service (NESS) from October 1975 to December 1978. Notes discuss identification of local terrain effect, case studies of synoptic situations, uncommon cloud features, and cloud pattern interpretations, which deal with the practical application of satellite data.

AWS/TN-79/004 (AD-A148050) *Results of a Wind-Dew Point Conditional Climatology Table Evaluation*, by Capt. M.J. Kelly, August 1979, 9pp. Two types of conditional climatology tables are described. Results show that wind-stratified conditional climatology (WSCC) tables and wind dewpoint conditional climatology (WDCC) tables have nearly equivalent skill. Author concludes there is insufficient justification for replacing WSCC tables with WDCC tables.

AWS/TN-79/005 (AD-A078744) *Forecast Skill Score Test*, by Lt. Col. William F. Johnson, Maj. Arthur C. Kyle, and Capt. Paul B. Knutson, December 1978, 35pp. Describes results of tests (conducted from 1 October 1977 to 31 March 1978) of different skill scores used by AWS. Also describes first organized AWS attempts to issue probability forecasts.

AWS/TN-80/001 (AD-A089706) *The REFORGER 76 MSI Test*, edited by Capt. Gary K. Dotson, June 1980, 83pp. REFORGER is an annual exercise to test US Forces' ability to support NATO commitments. During the 1976 exercise, AWS tested a new way to provide war/contingency support: objectively produced, single-number, Mission Success Indicators (MSIs). During REFORGER 76, AWS provided MSIs for four scenarios or mission types: COBRA/TOW vs. tank, 105mm gun vs tank, close air support, and helicopter assault. For 3 months before exercise, AWS spent nearly 5 man-years in MSI development. Report details events leading to effort, models developed, support provided, forecast verification, customer feedback, and future efforts. Essentially a compilation of reports submitted by AWS units participating in the exercise.

AWS/TN-80/002 (AD-A099511) *Follow-On Training Slide/Tape Preparation Guide*, by Maj. Thomas C. Wann, August 1980, 13pp. Tells how to prepare AWS follow-on training slide/tape programs. Gives guidance on visual aid and script preparation. Includes lead and end slide formats and sequence instructions.

AWS/TN-80/003 (AD-096797) *Atmospheric Sensitivities of High Energy Lasers*, by Lt. Col. Thomas

H. Pries, September 1980, 18pp. Describes atmospheric effects (attenuation and defocusing) on high energy lasers. Discusses significance of those effects and how they reduce energy density on targets.

AWS/TN-81/001 (AD-099778) *Forecasting Skill*, by Col. Kenneth E. German, January 1981, 51pp. Although accuracy of centrally-produced prognoses has improved in the past 20 years, several studies have shown negligible improvement in weather forecasting. More than 100 journal articles were reviewed to independently evaluate weather forecasting improvement. Forecasting skill was improved for most weather elements, but not by all forecasters. This led to a review of other factors (education, experience, interest, and procedures) that might be important in determining forecasting skill. After basic education and experience are achieved (2-3 months), the main factor contributing to forecasting skill was found to be forecaster motivation.

AWS/TN-81/002 (AD-103289) *Technical Bible for New Detcos*, by Maj. Frank J. Carvell, May 1981, 78pp. The greatest technical challenge for AWS is to improve the basic skill level of a highly intelligent and motivated, but extremely inexperienced, forecasting team. Most of this responsibility falls on already overworked detachment commanders (Detcos). If followed, this guide will help Detcos: organize their technical forecasting program more quickly and effectively, and provide them the tools required to lead, teach, and train their forecasting teams to reach full potential.

AWS/TN-81/003 (AD-113110) *East Coast Fog: A Case Study*, by Maj. Thomas C. Wann, November 1981, 18pp. Study covers 48-hour period (December 27-29, 1980) as an abnormal cold air mass over the eastern seaboard met warm, moist onshore flow. As a result of a strong pressure gradient, brisk onshore flow developed between an intensifying high and deepening low. Study emphasizes the need for a local analysis program that will detect onshore flow and possible extensive fog formation. Note: DTIC copy partially illegible.

AWS/TN-82/001 (AD-A113034) *Climatology Handbook for VII Corps Forward Areas*, January 1982, 128pp. Provides climatology of significant weather that can be expected to affect tactical operations in VII Corps forward areas. Available from AFWTL in standard 8 x 11" format or in pocket-sized version for mobility kits. Produced by USAFETAC/OL-A.

AWS/TN-82/002 (AD-A114728) *Climatology Handbook for Northag Forward Areas*, January 1982, 128pp. Provides climatology of significant weather that can be expected to affect tactical operations in NORTHAG forward areas. Available from AFWTL in standard 8 x 11" format or in pocket-sized version for mobility kits. Produced by USAFETAC/OL-A.

AWS/TN-82/003 (AD-A119172) *The Platteville Radar Profiler as a Meteorological and Communications Engineering Tool*, by Capt. Gregory D. Nstrom, January 1982, 16pp. Basic operating principles and capabilities of the VHF pulsed doppler radar at Platteville, Colorado, are discussed. Examples of horizontal and vertical wind speed are discussed. Examples of horizontal and vertical wind speed measurements are given, and meteorological uses for these data are briefly outlined. The radar backscattered power is used to compute the refractivity turbulence structure constant. New results on the variability of the refractivity turbulence structure constant from about 5-15 km are given. Especially interesting is the large diurnal change of the constant in the upper atmosphere.

AWS/TN-82/004 Not used.

AWS/TN-82/005 (AD-A141226) *Tilted Refractive Surfaces at Eglin Air Force Base, Florida*, by Jeffrey S. Schleher, November 1982, 4pp. Radar ducting layers along the Gulf coast of Florida are examined for a 9-day period in May of 1976. Tilted refractive surfaces are shown to exist with enough slope to significantly increase the chance of radar ducting at small look angles. Radiosonde observations agree with average refractometer measurements but do not detect ducting layers with small vertical depths. Reprint from Radio Science, Volume 17, Number 5, September-October 1982. Available in microfiche only.

AWS/TN-83/001 (AD-A132187) *The Operational Meteorology of Convective Weather, Volume I: Operational Mesoanalysis*, by Charles A. Doswell III, National Severe Storms Forecast Center, Kansas City, Mo., November 1982, 172pp. A reprint of NOAA Tech Memo NWS NSSFC-5. Addresses operational mesoanalysis associated with convective weather. Discusses physical interpretations of the dynamics that govern the atmosphere and, in particular, convection. Describes upper air data analysis with emphasis on vertical motion, thermodynamic and kinematic considerations and soundings; surface data analysis,

including discontinuities, boundaries, pressure and thermal analysis, and terrain features. Objective analysis tools and interpretation of numerical guidance are also discussed. Emphasizes the fact that mesoanalysis must be based on physical understanding. The concept of integrating all available analysis tools into a physically consistent picture, as opposed to basing the analysis on particular weather charts, is heavily stressed.

AWS/TN-85/001 (AD-A159919) *The Operational Meteorology of Convective Weather, Volume II: Storm Scale Analysis*, by Charles A. Doswell III, Environmental Sciences Group, Boulder, Colo., April 1985, 240pp. A reprint of NOAA Tech Memo ERL ESG-15. Deals primarily with fundamental aspects of convective meteorology. To present storm-scale meteorology, a wide range of topics are considered. Certain subjects, such as precipitation physics, are examined at length to provide basic physical understanding of how thunderstorms work. A classification scheme for convective storms is introduced, allowing the reader to make certain physical distinctions in the way storms are organized and how they behave.

AWS/TN-85/002 (AD-B099411) *Intelligence Preparation of the Battlefield—A Staff Weather Officers Guide*, by Maj. Edward J. Eadon, AFCSA/SAGW, November 1985, 27pp. Introduces Air Weather Service staff weather officers (SWOs) to the U.S. Army's Intelligence Preparation of the Battlefield (IPB) process. Provides step-by-step guidance for SWOs in producing climatology support for IPB. Identifies ways for SWOs to determine weather thresholds that affect Army operations. Describes methods for gathering and analyzing climatology data. Provides tables showing terrain influences on climatology patterns. Discusses forms a SWO may use to provide climatology inputs to IPB. *Notice: Distribution authorized to U.S. Government agencies and their Contractors, Administrative or Operational Use, April 1984. Other requests for this document shall be referred to: AFWA/XO.*

AWS/TN-86/001 (AD-A172801) *AFGWC's Advanced Weather Analysis and Prediction System (AWAPS)*, by Maj. James G. Stobie, June 1986, 68pp. Describes the three computer models used in the Air Force Global Weather Central's Advanced Weather Analysis and Prediction System (AWAPS) and explains how they interact to form a production cycle. These models are

the High Resolution Analysis System (HIRAS), the Global Spectral Model (GSM), and the Relocatable Window Model (RWM). Also gives brief introduction to the basics of numerical weather prediction.

AWS/TN-87/001 (AD-B114528) *What's Hot and What's Not—A Practical Guide to the Tactical Decision Aid*, by Capt. Jason P. Tuell, Det., 2nd WS, July 1987, 157pp. A practical guide for computing and providing Infrared and Television (IR/TV) Tactical Decision Aid (TDA) data, based on Air Weather Service experience in supporting test and development of precision guided munitions at Eglin AFB, Florida, since 1984. The system described here was designed initially for use with the HP-41 calculator, but the reasoning process and adjustments used to modify the calculator TDA output can be used with microcomputer versions, as well. Electrooptical theory is discussed only in as much detail as required for practical use of the TDA. Describes TDA's strengths and weaknesses, along with some operational strategies. **Notice: Distribution authorized to the Department of Defense and DoD contractors only, critical technology, 10 July 1987. Other requests shall be referred to AFWA/XO, Offutt AFB NE 68113. WARNING—This document contains technical data whose export is restricted by the Arms Control Act (Title 22, U.S.C., Sec 2751 et seq) or the Export Administration Act of 1979, as amended (Title 50, U.S.C., App. 2401, et seq). Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with the provisions of AFI 61-204.**

AWS/TN-87/002 (AD-A207904) *Isentropic Analysis and Interpretation: Operational Applications to Synoptic and Mesoscale Forecast Problems*, by Dr. James T. Moore, St. Louis University, Department of Earth and Atmospheric Sciences, July 1987, 93pp. Revised May 1989. A basic review of the isentropic coordinate system, including advantages and disadvantages for operational use. Primitive equations in isentropic coordinate form are discussed with emphasis on physical meaning and interpretation. Isentropic analysis techniques for "horizontal" and cross sectional perspectives are described as aids for diagnostic analysis of synoptic scale weather systems. Numerous diagnostic variables are discussed; all tools for identifying synoptic scale features helpful in forecasting cyclogenesis and regions susceptible to strong convection. Final section presents specialized applications of isentropic techniques to weather analysis

and forecasting, including trajectory analysis, tropopause folding process, short-term forecasting of severe weather threat areas, and aviation forecasting.

AWS/TN-87/003 (AD-B120890) *Weather Sensitivities of Electrooptical Weapons Systems*, by Maj. John R. Elrick and Capt. Arthur C. Meade, November 1987, 54pp. Describes weather sensitivities of electrooptical precision guided munitions (PGMs) and target acquisition systems (TASs). Provides basic radiation theory necessary to understand how PGMs and TASs work and how weather affects their performance. Includes glossary of EO-related terms, bibliography. Appendix A provides abstracted technical documents related to electrooptics; Appendix B lists Air Weather Service-approved tactical decision aids for supporting EO weapons systems. **Notice: Distribution authorized to U.S. government agencies and their Contractors only. Administrative or Operational Use, 15 October 1987. Other requests for this document shall be referred to AFWA/XO, Offutt AFB NE 68113.**

AWS/TN-88/001 (AD-B120515) *Satellite Imagery Interpretation for Forecasters*, February 1988, 634pp. Originally published as NOAA Weather Service Forecasting Handbook No. 6, May 1986, the result of a joint effort by Air Weather Service, the Naval Oceanography Command, the National Weather Service, and the National Environmental Satellite Data and Information Service. Republished as AWS technical note mainly to effect registration with DTIC. This operational handbook for GOES weather satellite imagery interpretation was designed as a satellite applications guide for the working meteorologist. It updates and replaces several other guides to GOES imagery use and interpretation. Draws on numerous sources, including AWS, Navy, and NOAA technical documents.

AWS/TN-91/001 (AD-A247588) *Dust and Sand Forecasting in Iraq and Adjoining Countries*, by MSgt. Walter F. Wilkerson, November 1991, 72pp. This report, based partly on the author's recent experience in desert weather forecasting, discusses airborne dust and sand in Iraq, Kuwait, Syria, eastern Jordan, western Iran, and the northern Arabian Peninsula. Describes geography of the region and discusses general types of duststorms and sandstorms. Locates and describes sources of sand and dust in Mesopotamia, Southwest Asia, and the Red Sea area. Provides practical tips and rules of thumb for forecasting airborne sand and dust. Describes methods

for enhancing the appearance of airborne dust in satellite imagery and provides example satellite imagery that shows airborne dust produced under several conditions.

AWS/TN-96/001 (AD-B207994) *Use of Polar-Orbiting Meteorological Satellite Data by Air Force Weather (AFW)*, by Maj. Michael Bonadonna and Capt. Louis Zuccarello, February 1996, 43pp. Identifies and justifies polar-orbiting meteorological satellite requirements of Air Force Weather. Specific requirements for atmospheric weather parameters and thresholds and space environmental parameters are given. In addition, it contains references to all known studies and documents that justify the requirements. **Notice: Distribution authorized to U.S. government agencies and their Contractors, Administrative or Operational Use, February 1996. Other requests for this document shall be referred to AFWA/DNT, Offutt AFB NE 68113.**

AFWA/TN-98/001 (AD-Pending) *Freezing Precipitation*, Eugene M. Weber, March 1998. Discusses three advection patterns favorable for freezing precipitation. This technical note is designed to help and train forecasters on various freezing precipitation scenarios.

AFWA/TN-98/002 (AD-Pending) *Meteorological Techniques*, AFWA/DNT Staff, July 1998. Contains weather forecasting techniques of interest to military meteorologists, in three sections: surface weather elements, flight weather elements, and severe weather. Includes both general and geographically specific rules of thumb, results of research, lessons learned from experience, etc., gathered from military and other sources. Update to earlier Air Weather Service Manual 105-56, *Forecasting Techniques*.

3-2. AFCCC TECHNICAL NOTES are published and distributed by the AFW Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019. USAF units order by TN number, AD number, and title from the AFWTL. **Note:** In 1995, USAFETAC was redesignated as the Air Force Combat Climatology Center (AFCCC)

USAFETAC-TN-68-2 (AD-669364) *Meteorological Rocket Data and Predicting the Onset of the Southwest Monsoon Over India and Southeast Asia*, by Edward V. Von Gohren, May 1968, 16pp. Recent independent results from several sources encourage further consideration of probable correlations between onset time of the southwest monsoon over southern South Vietnam, the advance of the southwest monsoon up the west coast of India, and stratospheric and mesospheric dynamics. This paper shows that there is an interrelationship or correlation between the southwest monsoon and the stratospheric circulation. Presented as example of value of synoptic meteorological rocket network data.

USAFETAC-TN-68-3 (AD-67276S) *Bibliographies of Climatic References and Climatic Maps for Selected Countries*, by Vincent J. Creasi, July 1968, 11pp. A list of climatological bibliographies for various countries worldwide. Each bibliography listed with its AD number and weather bureau designation. These publications compiled by the Foreign Area Section, Office of Climatology, U.S. Weather Bureau (now ESSA). Most bibliographies sponsored (contracted) by AWS through its Climatic Center (now AFCCC). Two distinct types of bibliographies included: (1) a listing of climatic references and (2) a listing of climatic maps.

USAFETAC-TN-68-4 (AD-683761) *A Climatological Bibliography of the South Atlantic Ocean Area Including Certain Coastal Countries*, by Alvin L. Smith, Jr., November 1968, 102pp. Contains 262 climatological references, with annotations, for the South Atlantic ocean area, Atlantic coastal countries of Africa and South America, and Antarctica. Items indexed by author, by country or area, and by weather element.

USAFETAC-TN-69-1 (AD-685716) *A Selected Climatological Bibliography for Thailand*, by Alvin L. Smith, Jr., March 1968, 44pp. Contains 105 separate sources of climatological data and text references for Thailand. All entries in alphabetical order by author or originating agency. All items furnished with abstract. Subject index included.

USAFETAC-TN-69-2 (AD-None) Incorporated in AWS/TI-79/001.

USAFETAC-TN-69-3 (AD-688259) *An Annotated Climatological Bibliography of Romania*, by Vincent J. Creasi, May 1969, 33pp. Contains 61 sources of climatological data and textual references for Romania. All items furnished with abstract. Subject index included. All items indicate source library.

USAFETAC-TN-69-4 (AD-688434) *Radar-Computed Rainfall Compared With Observations From a Dense Network of Rain Gauges*, by Capt. Martin Ross, June 1969, 10pp. Using Wilson's Rainfall Rate - Echo Intensity (RR-EI) Chart, based on the average relationship, radar data collected for 36 hours, using US Weather Bureau WSR-57 at Atlantic City, N.J., is compared with rainfall data from three tipping-bucket rain gauges located within 60 nm of radar over area of 4.8 square miles. Comparisons between radar and tipping-bucket gauges are shown. Radar measurements were within 2 percent of total rain gauge average. Correlation coefficient was .91. Use of Weather Bureau RR-EI chart would have underestimated average areal precipitation. Hourly rainfall amounts of 0.01 inches detected in 80 percent of cases. Hourly amounts of 0.02 inches or more detected in 100 percent of cases.

USAFETAC-TN-69-5 (AD-691006) *Tractionability Study for the Laotian Panhandle*, by MSgt. Thomas E. White, July 1969, 46pp. Study provides percent frequency of various tractionability classes (Thorntwaite's method) for 12 stations in the Laotian Panhandle and one in South Vietnam. Stations are along major road networks in Laotian Panhandle. Data presented in tabular and graphic form.

USAFETAC-TN-69-6 (AD-691432) *An Annotated Climatological Bibliography of India*, by Dennis L. Boyer and Alvin L. Smith, Jr., August 1969, 61pp. Contains 141 climatological references, with annotations, for India. Indexed. All items published after 1959.

USAFETAC-TN-69-7 (AD-69.5482) *A Selected Bibliography on the Climate of the Central American*

Countries, by Vincent J. Creasi, September 1969, 34pp. Contains 69 climatological references, with annotation, for the Central American countries. Indexed.

USAFETAC-TN-69-8 (AD-697020) *A Selected Annotated Bibliography on Lightning (1964-1969)*, by Alvin L. Smith, Jr., and Dennis L. Boyer, November 1969, 47pp. Contains 126 annotated references on lightning. Subject index included, shows numbered items pertaining to each subject breakdown. A number of pertinent textbooks given in separate listing.

USAFETAC-TN-69-9 (AD-696617) *Rain Models for Landing Guidance Systems*, by Maj. Gordon A. Beale, November 1969, 15pp. Models of rain intensity along an aircraft glide slope are derived to compare attenuation losses at various radar frequencies. Models are intended to portray rain intensity over a 10-minute period and 10- or 20-mile ground track. Rain intensities are selected to represent rates that would occur less than one percent or 0.1 percent of the time during the rainy season at the rainiest airfield in the U.S. and the rainiest airfield (with more than 5,000 feet of paved runway) in the world.

USAFETAC-TN-70-1 (AD-700057) *A Selected Annotated Bibliography on Clear Air Turbulence (CAT)*, by Dennis L. Boyer and Alvin L. Smith Jr., January 1970, 117pp. Contains 220 references on clear air turbulence, with annotations. References listed alphabetically by author by year. References for the most part refer to turbulence as it appears in the free atmosphere, and represent views from authors/agencies worldwide.

USAFETAC-TN-70-2 (AD-701692) *An Annotated Climatological Bibliography of the Benelux Countries (1960-1969)*, by Dennis L. Boyer and Alvin L. Smith, Jr., February 1970, 75pp. Contains 132 climatological references for the Benelux countries published during 1960-1969. Items arranged alphabetically by author for each country. Section of general references is included and a subject index is furnished.

USAFETAC-TN-70-3 (AD-None) Incorporated in AWS/TI-79/001.

USAFETAC-TN-70-4 (AD-705199) *A Selected Annotated Bibliography of Environmental Studies of Israel (1960-1969)*, by Vincent J. Creasi, Dennis L. Boyer, and Alvin L. Smith, Jr., April 1970, 59pp. Contains 119 references to environmental studies on

Israel. References listed alphabetically by author by year. Subject index included. Non-English language studies annotated in left margin.

USAFETAC-TN-70-5 (AD-707120) *A Selected Annotated Bibliography of Environmental Studies of Iraq, Jordan, Lebanon, and Syria (1960-1969)*, by Vincent J. Creasi, Dennis L. Boyer, and Alvin L. Smith, Jr., May 1970, 36pp. Contains 112 references to environmental studies for four middle east countries (Iraq, Jordan, Lebanon, and Syria). About 50 items are general references that pertain to one or more of the subject countries. Sixteen additional bibliographies of a meteorological and climatological nature are listed. Entries listed alphabetically by author; subject index included.

USAFETAC-TN-70-6 (AD-709762) *A Selected Annotated Bibliography of Environmental Studies of Poland*, by Alvin L. Smith, Jr., June 1970, 59pp. Contains 153 references to environmental studies (1960-1969) on the Polish Peoples Republic. Of these, 43 reference translations of Polish articles are placed separately in text. Five previously published bibliographies are also referenced. Entries are alphabetical by author; subject index included.

USAFETAC-TN-70-7 (AD-691228) *Air Force Eastern Test Range Computer "Printed" Rawinsonde (Skew-T) Analysis*, by Irving Kuehnast, June 1969, 23pp. Report intended as a guide to forecasters using Air Force Eastern Test Range computer "printed" rawinsonde (Skew-T) analysis. Each meteorological element on the computer printout is described as to what it is, how it is computed and developed, why it is included in the analysis, and its relationship to a Skew-T analysis.

USAFETAC-TN-70-8 (AD-711794) *Hook Echoes on Radar*, by John W. Stryker, August 1970, 17pp. A great amount has been published on tornado activity and hook echoes on radar. This paper discusses one popular tornado theory and explains existence of the hook echo on radar. The tornado model used is that developed by the late Dr. Fred Bales. On the basis of the tornado theory, a steady-state storm develops with a rotating updraft at the center. The potential for tornadic development is on the convergent or windward side of the cell. The hook echo as viewed on radar, while not assumed to be the tornado itself, has an extremely high correlation with tornado occurrence of funnel cloud sighting. The question posed is: What is this hook echo and how is it

associated with the tornadic vortex? By using the model in the Bates theory, a satisfactory conclusion can be derived.

USAFETAC-TN-70-9 (AD-714568) *The National Air Pollution Potential Forecast Program*, by Edward Gross, May 1970, 33pp. Air pollution potential (APPI) is defined as a measure of the inability of the atmosphere to adequately dilute and disperse pollutants based on values of specific weather elements of the macroscale features. To delineate areas on the macroscale in which high APP has the greatest probability, a stagnation index has been developed independent of mixing height and transport wind speed data. Associated stagnation conditions usually manifested by stable stratification, weak horizontal wind speed components, and little, if any, significant precipitation. Report describes numerical and subjective means by which stagnation areas are delineated, how mixing height and transport wind speed are calculated, and how high APP conditions are transmitted to users.

USAFETAC-TN-70-10 (AD-717196) *A Selected Annotated Bibliography of Environmental Studies of Argentina, Chile, and Uruguay*, by Vincent J. Creasi, December 1970, 46pp. Compiled as a by-product of routine USAFETAC reference-searching. Many abstracts taken from publications themselves, others from meteorological and geostrophysical abstracts (Am. Met. Soc.). Others prepared by USAFETAC.

USAFETAC-TN-71-1 (AD-718966) *Interim Instructions for the Use of the National Meteorological Center Air Pollution Potential (APP) Products*, by Valentine J. Descamps, February 1971, 25pp. Report furnishes interim instructions and guidance for AWS use of NMC air pollution potential products. NMC products are transmitted on COMET III and FOFAX to AWS detachments for use in providing guidance to base pollution control officers. Report explains terms, tells how to apply messages to forecast preparation, and gives guidelines for tailoring information furnished by NMC to local requirements.

USAFETAC-TN-71-2 (AD-719866) *A Reprint of Use of FOUS (Detailed PE Guidance)*, by Frederick P. Ostby, March 1971, 25pp. Intended to give AWS forecasters, especially in the Zone of Interior (conus), guidance for using National Weather Service FOUS bulletins begun on 15 February 1971. It includes NWS papers prepared for NWS forecasters. AWS

acknowledges cooperation of NWS Technical Procedures Branch.

USAFETAC-TN-71-3 (AD-None) Incorporated in AWS/TI-79/001.

USAFETAC-TN-71-4 (AD-724645) *Diurnal Variation of Summertime Thunderstorm Activity Over the United States*, by Maj. Eugene M. Rasmusson, USAFR, April 1971, 16pp. Observations from 294 Air Force and National Weather Service stations throughout the United States, were used to study diurnal variation of summertime thunderstorm activity. Results of study summarized in isoline frequency charts giving monthly values of 24-hour mean, variance of mean hourly values, hours of maximum frequency, along with phase, amplitude, and explained variance of diurnal and semidiurnal harmonics.

USAFETAC-TN-71-5 (AD-725738) *Preliminary Verification of AFGWC Boundary-Layer and Macroscale Cloud-Forecasting Models*, by Capt. John W. Diercks, June 1971, 18pp. Report gives results of a limited verification program of temperature and dew-point forecasts from the AFGWC boundary-layer (BLM) and macroscale cloud-forecasting models using six U.S. locations. Guidance in this report necessarily broad because of problems encountered in gathering and processing large data samples. Improvement over persistence forecasts shows the BLM to have considerable skill east of the Rockies but little or no skill along the western boundary and in mountainous areas.

USAFETAC-TN-71-6 (AD-729022) *Use of Extrapolation in Short-Range Forecasting (Case Study)*, by CMSgt. Robert E. Clark, September 1971, 17pp. Gives step-by-step procedure for extrapolating movement of certain weather phenomena using surface and upper-air analyses. Short-range forecasting (0-4 hours) is emphasized; case study (using technique given here) included for Scott AFB, Ill.

USAFETAC-TN-71-7 (AD-731554) *Glossary of Spanish, French, German, English Selected Climatological and Meteorological Terms*, by SSgt. Allen R. Meals and Vincent J. Creasi, August 1971, 30pp. Cross-references English, French, German, and Spanish meteorological terms most commonly used in tables, figures, and maps.

USAFETAC-TN-71-8 (AD-732765) *A Prediction Method for Blast Focusing*, by Capt. Richard A. Rassmussen, September 1971, 32pp. Discusses an overpressure forecasting technique established by the Ballistic Research Laboratories (BRL) at Aberdeen Proving Ground, MD. Method involves calculating forecast representative value of speed of sound for azimuth angles for layers 1,000 to 10,000 feet. Using graphs, over-pressure intensity and focal points where critical overpressure will occur are pinpointed and semi-objectively forecast. Should help units providing blast damage forecasts. Change, January 1972, 1p.

USAFETAC-TN-71-9 (AD-733505) *Determination of Maximum Emission Rates to Meet Air Quality Standards*, by Lt. A. Roger Greenway and Maj. David S. Lydon, August 1971, 22pp. Explains technique used to calculate allowable stack emissions for certain AF bases within limits of Environmental Protection Agency air quality standards. Examples of calculations for Cape Kennedy AFS, Kelly AFB, and Tinker AFB are given. Graphs of "emission rate vs downwind distances" are furnished to allow downwind ground-concentration of specific pollutants to be readily estimated for effective stack heights of 30, 50, and 70 feet.

USAFETAC-TN-71-10 (AD-731162) *A Resume of Short-Range Forecasting Techniques*, by Joe S. Restivo, September 1971, 14pp. Certain techniques to improve short-range forecasting discussed briefly. References furnished for more detailed information.

USAFETAC-TN-71-11 (AD-732205) *Numerical Preprocessing of Rawinsonde Position Vectors*, by Maj. Thomas E. Stanton, October 1971, 27pp. Martin-Graham filters are used subsequent to correction or erroneous data points to smooth Rawinsonde Set AN/GMD-4 spherical measurements. Smoothing produces not only a corrected wind profile, but allows orderly pressure integration of the hydrostatic equation. Major data problems besides high frequency elevation-angle noise include range jumps and diffraction phenomena. Range jumps identified and corrected by inspection of first and second differences in range field. Diffraction phenomena adjusted by assuming linear change in balloon ascent-rate field and reconstructing elevation angles. Other erroneous data adjusted by comparing filtered with raw data and imposing limitations on height, wind, and position vector fields.

USAFETAC-TN-71-12 (AD-733586) *Clock-Hour/Instantaneous Rainfall Rate Relationships Applicable to the Eastern United States*, by Capt. Patrick J. O'Reilly, December 1971, 23pp. Describes methodology that provides climatological estimates of frequencies of instantaneous rainfall rates at a point and along a surface horizontal path length as a function of clock-hour rate. Clock-hourly precipitation amounts used since they are available for a period of record for many first-order stations in CONUS and for a selected number of overseas locations. Point instantaneous rainfall rates (measured at Island Beach, New Jersey; Franklin, North Carolina; and Miami, Florida) provided inputs to these clock-hour/instantaneous rate relationships, use is intended primarily for Eastern U.S.

USAFETAC-TN-72-1 (AD-None) Superseded by USAFETAC/TN-86/001.

USAFETAC-TN-72-2 (AD-736451) *A Survey of Availability of Hurricane/Typhoon Packages and Associated Data*, by TSgt. Allen R. Meals, January 1972, 20pp. Survey outlines types and format of data available on tropical cyclones. Emphasis is on data packages assembled for individual storms. List of sources for currently available packages provided. Catalog of data archived at National Climatic Data Center, Asheville, N.C., included, along with bibliography of long-term tropical storm climatology.

USAFETAC-TN-72-3 (AD-None) Incorporated in AWS/TI-79/001.

USAFETAC-TN-72-4 (AD-738594) *A Selected Annotated Bibliography on the Tropopause*, by Sgt. Larry N. Huff, February 1972, 38pp. Contains over 100 items. Entries include brief abstract. Language in which references are available noted, along with library reference or source. Articles published from 1956-1971 are included.

USAFETAC-TN-72-5 (AD-741806) *A Selected Annotated Bibliography of Environmental Studies of Italy (1952-1971)*, by Sgt. Larry N. Huff, Vincent J. Creasi, and Hilda J. Snelling, May 1972, 38pp. Includes 103 references to 12 recurring publications on environmental studies of Italy and discussions of their contents.

USAFETAC-TN-72-6 (AD-744824) *An Investigation Into the Proper Spatial and Temporal Frequency of the Meteorological Rocketsonde Network*, by Lt. Col. Walter I. Christensen, Maj. Terrell D. McCorrey, and CMSgt. Ernest Fisher, June 1972, 24pp. Study presents brief history of the rocketsonde network and lists present and anticipated requirements for rocketsonde data. Authors express need for an optimum network that would satisfy spatial and temporal requirements necessitated by expanding need for timely and accurate rocketsonde observations.

USAFETAC-TN-72-7 (AD-755402) *Random Error Variance and Covariance Estimates from Simultaneous Radar (FPS-16) Measurements*, by Donald R. Johnson and Gary Thompson, September 1972, 17pp. Technique of differences or replication modified so as to estimate pure random error variance and covariance components from simultaneous measurements, either by radar (FPS-16) or direction finding (AN/GMD-1A) observing systems. An example of random error variance estimation in simultaneous FPS-16 observations is presented. Technique applicable to determination of uncertainty of derived estimates from basic data, such as geographical position, wind, wind shear, Richardson number, etc.

USAFETAC-TN-72-8 (AD-755403) *An Operational Decision Model Employing Operational and Environmental Factors*, by Lt. Dana P. Hall, November 1972, 22pp. Model discusses combined conditional climatological probabilities, climatological probabilities, and operational loss values for specified actions in a way that allows for best operational decision. Sample scenario given and demonstrated, using hypothetical problem of airlift supply. Note: Available from DTIC in microfiche only.

USAFETAC-TN-73-1 (AD-A004535) *Interim Instructions for the Use of Air Stagnation Weather Charts and Messages*, by Valentine J. Descamps, revised by Capt. Don W. Janssen, June 1976, 21pp. Instructions and information herein will help forecasters interpret and tailor air stagnation facsimile charts and teletype messages to local requirements. Explains messages and charts available and covers their use. Procedures for overseas and domestic use included. Note: Operationally obsolete; for historical and research use only.

USAFETAC-TN-73-2 (AD-768391) *The Ocheltree Tornado: A Case Study*, by Capt. William E. Finley, 1st

Lt. Charles A. Perry, and SSgt. Billy W. Brown, March 1973, 35pp. A classic example of a midwestern United States tornado occurred near Richards-Gebaur AFB, Mo., on 1 May 1972 (GMT date) as an associated feature of a steady-state severe thunderstorm. This case study describes synoptic and mesoscale aspects of the situation using meteorological charts and diagrams and includes radar scope photographs from the AN/FPS-77 storm detection radar at Richards-Gebaur AFB. Included in photographs are several highly unusual range height indicator (RHI) sections through the parent thunderstorm and tornado tube. A partial survey of damage caused by the tornado included. Some suggestions to non-centralized weather forecasters for coping with an imminent tornadic thunderstorm presented in final section.

USAFETAC-TN-73-4 (AD-762501) *USAFETAC Refractive Index Gradient Summaries*, by Allen R. Davis and Capt. Richard C. Wagner, April 1973, 20pp. Upper-air soundings are used to compute refractive-index gradients in the lower atmosphere that cause normal and anomalous propagation of radio waves. This note describes the computer-produced summaries of these gradients. Gradients described by height of base and thickness for each of four categories: sub-refractive, normal, super-refractive, and trapping. Tables also describe gradients by height of base in discrete intervals, and give monthly distributions of the minimum gradient for each sounding.

USAFETAC-TN-73-5 (AD-762938) *Short-Range Weather Forecasting: Recent Developments in Air Weather Service, Suggested Techniques*, by CMSgt. Robert E. Clark, May 1973, 29pp. Examines short-range terminal forecasting capabilities of AWS detachments. Techniques suggested for furthering accuracy of these forecasts; case study using suggested techniques is included as guidance. An AWS Test Form No. 52 discussed and practical applications indicated.

USAFETAC-TN-73-6 (AD-767214) *A Resume on the State of the Art for Snow Forecasting*, by SMSgt. Charles L. Brenton, Jr., July 1973, 34pp. Discusses various predictors and techniques used to forecast snowfall and to make distinction between frozen and liquid precipitation. Techniques applicable to short-range, midrange, and extended-range forecasts. Includes 53 references on snow forecasting in the US.

USAFETAC-TN-74-1 (AD-784814) *Atmospheric Moisture Parameterization*, by Capt. Robert D. Smith, January 1974, 26pp. There are requirements for estimation of the spatial distribution of liquid and solid water in the atmosphere. Evaluation of previous research indicates that the amount of water at a point can be approximated from the temperature and type of cloud at that point, along with the relative position of the point in the cloud. Thermodynamic phase of the water and what portion is liquid or solid can be generalized from the temperature of the point. Drop-size distribution can be determined by assuming that available water is found in distributions typical of various types of clouds.

USAFETAC-TN-74-2 (AD-A056234) *Development of a Gridded Data Base*, by Capt. Robert G. Feddes, April 1974, 83pp. Appendix A, the 3DNEPH data base, Appendix B, analysis data base summary, Appendix C, the usefulness of the gridded conventional data base for climatic application. With the advent of numerical analysis adapted to a large computer system, global automated analysis of a variety of meteorological elements became operational at Air Force Global Weather Central (AFGWC). At USAFETAC, these gridded analyses are maintained as one of the historical data sets used to support a wide variety of data application requests. Gridded analyses now used at USAFETAC are in two distinct forms and include a global analysis of conventional elements and a global analysis of the cloud scene at a variety of standard analysis times. This note describes USAFETAC efforts in development of these historical data bases. Contains an explanatory appendix for each data base, as shown.

USAFETAC-TN-74-3 (AD-A002117) *A Precipitating Convective Cloud Model*, by Capt. Robert D. Smith, May 1974, 51pp. Model presenting a physical depiction of a precipitating convective cloud is explained in detail. Mathematical computations shown, and computer program given. Program uses the primitive equations with initial conditions to compute desired atmospheric elements in two dimensions at some later time. Initial conditions defined by reference temperature, surface temperature, temperature change with height, surface wind, wind shear, and moisture distribution. Model limitations defined by grid interval, grid size, maximum simulated time, and maximum number of iterations.

USAFETAC-TN-74-4 (AD-A002118) *A Synoptic-Scale Model for Simulating Condensed Atmospheric Moisture*, by Capt. Robert G. Feddes, June 1974, 26pp.

Determination of a synoptic-scale model for simulating condensed atmospheric moisture by USAFETAC Scientific Services Branch and applications for which model may be used are detailed. Study treats the use of gridded inputs to perform the environmental simulations and explains use of two portions of a data base maintained by USAFETAC. The two data bases are a global cloud analysis (3DNEPH) and a global analysis of conventional elements. Input to the model includes low, middle, high, or convective cloud types (3DNEPH), layered cloud amounts (3DNEPH), present weather conditions (3DNEPH), base, tops and midpoints of layers (AFGWC model terrain), and temperature and D-value profiles (AFGWC gridded hemispheric analyses).

USAFETAC-TN-75-1 (AD-A004097) *Estimated Improvement in Forecasts of the SANBAR Hurricane Model Using the Airborne Weather Reconnaissance System (AWRS)*, by Capt. Albert R. Boehm, January 1975, 13pp. SANBAR is a one level, barotropic model that forecasts hurricane position. Inputs such as storm movement and maximum winds were selectively varied to measure sensitivity to errors. SANBAR is most sensitive to movement error and somewhat sensitive to errors in maximum wind. Movement error depends primarily on errors in successive storm fixes. Knowing the current aircraft error, forecast error can be split into modeling error and observational error. Using new Airborne Weather Reconnaissance System observations, the SANBAR 24-hour mean vector error is expected to be 60 vs the current 113 NM.

USAFETAC-TN-75-2 (AD-A006691) *Spring Weather Patterns of the Western United States*, March 1975, 78pp. Reprints of NWS Western Region Technical Attachments 74-6, 74-8, 74-12. Reprinted data furnish excellent climatic guides to spring weather patterns over the western United States. Data covers March, April, and May, concerns most normally-observed weather elements.

USAFETAC-TN-75-3 (AD-A009860) *Summer Weather Patterns of the Western United States*, May 1975, 75pp. Reprints of NWS Western Region Technical Attachments 74-14, 74-18, and 74-21. Data covers June, July and August.

USAFETAC-TN-75-4 (AD-A013801) *Autumn Weather Patterns of the Western United States*, July 1975, 68pp. Reprints of NWS Western Region Technical

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Attachments 73-35 (with supplement), 74-27, 73-39 (with supplement), 74-32, and 73-41. Data covers September, October, and November.

USAFETAC-TN-75-5 (AD-A057745) *Winter Weather Patterns of the Western United States*, September, 1975, 71pp. Reprints of WWS Western Region Technical Attachments 73-42, 74-1, and 74-3. Data covers December, January, and February.

USAFETAC-TN-76-1 Not used.

USAFETAC-TN-76-2 (AD-A070154) *Some Aspects of Estimating the Probability of Cloud-Free Lines-of-Sight in Dynamic Situations*, by Ronald J. Nelson and Mead B. Weatherbe, March 1976, 51pp. Dynamic cloud-free line-of-sight (CFLOS) problems involve either moving points between which the line-of-sight is to be assessed or a time during which the line-of-sight between two points, moving or stationary, is to be assessed. There are no adequate assessment techniques available for these kinds of problems. As a preliminary step toward developing required techniques, variables associated with certain types of dynamic CFLOS problems are examined, and a computer program that models space/time aspects of these types is presented.

USAFETAC-TN-76-3 (AD-A037148) *Model Output Statistics Forecast Guidance*, by Capt. Harry G. Hughes, September 1976, 20pp. Describes data in National Weather Service Model Output Statistics Final Forecast Guidance teletype bulletins; a guide to interpretation and use of these bulletins. Change 1, May 1977, 3pp.

USAFETAC-TN-77-1 Not used.

USAFETAC-TN-77-2 (AD-A062955) *USAFETAC DATSAV Data Base Handbook*, December 1977, 80pp. Reprint incorporates errata dated August 1987 and November 1988. Describes format of meteorological data (surface, upper-air, and aircraft reports) stored at USAFETAC. See also USAFETAC/UH-86/004.

USAFETAC-TN-77-3 (AD-None) *Soil Moisture Agrometeorological Services*, by Maj. William J. Sturm, June 1977, 33pp. Provides a technical synopsis of the automated programs used operationally by USAFETAC to satisfy agrometeorological requirements. Describes the Thomwaite Bookkeeping Method and the Penman Radiation Equations. Either method fully develops all

steps used to produce final results used to monitor crop conditions around the world.

USAFETAC-TN-77-4 (AD-A131915) *The Impact of Winds-Aloft Errors on Air-To-Ground Ballistic Ordnance Deliveries*, by Capt. Robert P. Wright, June 1977, 37pp. Gives procedure for estimating how errors in upper-wind information affect bombing accuracy in normal delivery of ballistic ordnance. Procedure resulted from analysis of on-site pibal support to Tactical Air Command ground attack training program.

USAFETAC-TN-77-5 (AD-None) *Computation of Solar Declination, the Solar Azimuth Angle, and the Equation of Time*, by Capt. Richard A. Goldsmith, September 1977, 31pp. Prepared as part of USAFETAC'S WWMCCS support to U.S. European Command. Gives procedures for applying Kepler's Equation to the earth's orbit, computing solar declination, with test results. Develops method for evaluating results of standard equation used to compute solar azimuth angle. Updates an equation used previously to compute equation of time. Note: Operationally obsolete; for historical and research use only. Not available from DTIC.

USAFETAC/TN-78/001 (AD-None) Incorporated in AWS/TI-79/001.

USAFETAC/TN-78/002 (AD-A059874) *A Technique for Estimating Clock Two-Hourly Precipitation Rate Distributions*, by Capt. Daniel J. McMorrow, May 1978, 18pp. Clock two-hourly precipitation rate distributions can be derived from distributions of clock-hourly precipitation rate distribution by using negative exponential functions. Analytical conversions are provided for 16 climatic regimes in CONUS and Alaska. Clock-hourly and two-hourly precipitation rate distributions also compared with instantaneous distributions measured over horizontal paths.

USAFETAC/TN-79/001 (AD-A069756) *USAFETAC Analyst/Programmer Handbook; IBM 360 DOS User's Guide*, by TSgt. Marvin L. Freimund, March 1979, 21pp. Gives brief description of IBM 360/44 computer system at USAFETAC; includes descriptions of system configuration, system organization, and system programming.

USAFETAC/TN-80/001 (AD-A085733) *Wind Factor Simulation Model; Model Description*, by Maj. Roger

C. Whiton and Capt. Patrick L. Herod, April 1980, 30pp. A simplified, small and efficient wind factor simulation (WFSM) is developed for inclusion in a Military Airlift Command (MAC) airlift system simulation called Colossus. The WFSM calculates climatological wind factors by Sawyer's equivalent headwind technique for arbitrary great circle routes at specified altitudes for any of four seasons in any of three wind options. This technique is combined with the mathematics of great circle navigation in a constellation of seven FORTRAN subprograms. In the WFSM, a simulated aircraft is navigated along a great circle route between any two points on the globe. Involved in the mathematics of the navigation is solving the evaluation of a great circle. This equation is sometimes transcendental. In these cases, Newton's iterative method for the solution of nonlinear algebraic equations is used. The WFSM also calculates the great circle distance in nautical miles and the initial heading in degrees of any two points whose latitude and longitude are known.

USAFETAC/TN-80/002 (AD-A085486) *Wind Factor Simulation Model: User's Manual*, by Maj. Roger C. Whiton and Capt. Patrick L. Herod, April 1980, 46 pp. User instructions and a concise description are provided for a wind factor simulation model (WFSM). The WFSM is a fast, economical module designed to reside as a collection of subroutines within the user's larger simulation model. The WFSM, upon call by the user, produces mean overall climatological wind factors for great circle routes between arbitrary points "a" and "b" (specified by latitude and longitude) anywhere on the globe. The WFSM produces wind factors in any of three modes (calm wind case, 90-percent worst case, and mean wind case), for either of two altitudes (25,000 and 35,000 feet) for any of four seasons of the year. In addition, the model can provide great circle distance between points "a" and "b." From this information and known airspeed, the user can calculate ground speed and adjusted flying time between "a" and "b." Software solves the equation of a great circle. Program listing and flow chart included.

USAFETAC/TN-80/003 (AD-A096796) *Bivariate Normal Wind Statistics Model: User's Manual*, by 2nd Lt. Benjamin Novograd, September 1980, 30pp. User instructions, sample input, sample output, and processing times are provided for USAFETAC/DND's Wind Statistics Model. This model's basic input consists of five wind statistics: Means and standard deviations of the zonal and meridional wind components, and the correlation coefficient of these components. The model

uses a bivariate normal distribution of these wind components to generate its output. The model's users can interactively select one or several of its output options. Each option generates a different type of output. The available options include: points on an elliptical probability contour, the probability of a range of wind directions, the probability of a range of wind speeds, the joint probability of a range of wind speeds and directions, new basic wind statistics, using a rotated coordinate system, and the conditional probability of a range of wind speeds given a wind direction.

USAFETAC/TN-80/004 (AD-A093196) *The Rank Input Method and Probability Variation Guides*, by Maj. Albert R. Boehm, July 1980, 13pp. The rank input method allows a forecaster's subjective estimate to be quantified into a probability forecast. The forecaster's estimate can be a rank input, a probability of a single category, or a categorical forecast. With the rank input, the forecaster ranks the synoptic situation—very bad to very good—in relation to the element to be forecast; e.g., surface visibility. The transnormalized regression probability model is then used to calculate the probability of the specific event. Probability of a single category can be converted to probabilities for one or more different categories. A categorical forecast can be converted to probability forecasts. A validation during REFORGER 78 concluded that the method shows promise and that forecasters were able to produce a large number of probability forecasts with a few simple rankings of the synoptic situation. Probability variation guides are tables giving forecast probability values for various inputs. Plotted on a simple graph, all values for a given skill and climatology fall along a single curve in probability space. These curves make certain decision analysis theorems much simpler in form.

USAFETAC/TN-81/001 (AD-A097048) *Soil Moisture and Agromet Models*, by Capt. Marvin A. Cochrane, Jr., March 1981, 36pp. Two automated models, known as soil moisture and Agromet, used operationally to monitor crop growing conditions, are described. The soil moisture model uses Thornthwaite's water balance method to estimate moisture variables from daily temperature and precipitation analyses. The model is relatively simple and has been providing useful information for over 20 years. The newer and more complex Agromet model estimates daily evaporation potential using Penman's equation. This model also uses a complex cloud analysis to estimate radiation effects. Agromet provides daily grid-point analyses of

temperature, precipitation, snow depth, radiation, and evaporation.

USAFETAC/TN-81/002 (AD-B066230) *Simulated Weather Impact Indicators: A Decision Assistance Technique Applied to Probability Forecasts of Weather Threshold for REFORGER 77 Exercises*, by Gary O'Connor, Roger C. Whiton, Albert R. Boehm, and Capt. Emil M. Berecek, June 1981, 39pp. USAFETAC provided tables of Simulated Weather Impact Indicators (SWIIs) in support of REFORGER 77. Report describes development of those tables, and their uses. Tables applicable for four threshold values of weather elements at 111 grid locations. SWIIs produced independent of any weapons system consideration. Weather forecasters could use SWIIs as forecast aids when tailored probability forecasts are required. Planners could use SWIIs along with weighting factors for a particular weapons system. SWIIs helped decision-makers by providing "yes/no" or "go/no go" forecasts based on probability theory. **Distribution limited to U.S. government agencies.**

USAFETAC/TN-81/003 Not used.

USAFETAC/TN-81/004 (AD-A113540) *Cloud Forecast Simulation Model*, by Maj. Roger C. Whiton, Capt. Emil M. Berecek, and 1st Lt. John C. Sladen, October 1981, 134pp. The model generates synthetic worldwide 3-hour total cloud cover forecast fields at 50-nautical mile resolution. Synthetic forecasts are generated stochastically, based on input verifying "observed" total cloud cover fields, in such a manner that the agreement between the synthetic cloud forecast field and its verifying observed field is no better nor worse than the agreement between actual cloud prognoses and their verifying observations. Moreover, a sawtooth wave submodel is used to ensure the synthetic cloud forecast fields have the same spatial correlation as do actual cloud prognoses. Therefore, the cloud forecast simulation model generates synthetic total cloud cover forecast fields that have the same skill and spatial correlation as the operational forecast product. The model is used to generate meteorological input to system planning and optimization simulations and system design studies. The sawtooth wave submodel could also be used to generate synthetic two-dimensional observed weather fields as well as cloud forecasts.

USAFETAC/TN-82/001 (AD-A118425) *A Comparison of the AFGL FLASH, Draper DART and AWS Haze*

Models With the RAND WETTA Model for Calculating Atmospheric Contrast Reduction, by Dr. Patrick J. Breitling, March 1982, 55pp. In 1975, USAFETAC was tasked to develop a model to calculate lock-on range for TV-guided precision guided munitions. Investigation revealed availability of several models for calculating contrast reduction by the atmosphere. These models, the Air Force Geophysics Lab (AFGL) FLASH model, the AWS Haze model, the Draper Lab DART model, and the Rand Corp. WETTA model, were compared with one another using the same input data. The FLASH Monte Carlo model was assumed as the standard for the comparison. Visible contrast transmission values were computed for all models for a TV sensor at 12,000 feet AGL, for two mixing depths (200 and 1,500 meters), two visibilities (5 and 23 kilometers), three solar zeniths (20, 60, and 85 degrees), three albedos (.06, .18, and .80), and seven dive angles: (85, 70, 50, 30, 20, 10 and 7 degrees). If one accounts for the difference in optical depths that results from Huschke's (Rand Corp.) staircase treatment of vertical extinction coefficients, his model does an acceptable job of approximating flash contrast transmission values for a visibility of 23 kilometers. With 5-km visibility, agreement is not as good due to combination of mathematical and geometrical factors.

USAFETAC/TN-82/002 Not used.

USAFETAC/TN-82/003 (AD-A118429) *Objective Analysis of Climatological Probability Data*, by Maj. Bryan E. Lilius, 1st Lt. Frederick C. Wirsing, and 2nd Lt. Robert M. Cox, July 1982, 105pp. Describes method for compacting, accessing, and analyzing ceiling/visibility probability data. Unconditional cumulative probabilities over the southern half of West Germany are analyzed. Technique used to compact data uses less than 1/8 computer storage normally required. Accuracy of data only slightly impaired. Three objective analysis algorithms were investigated: Barnes, Janola, and nearest neighbor. The Barnes method performed best. Independent data were estimated, using this technique with a mean error of 3.2 percent.

USAFETAC/TN-82/004 (AD-A123342) *Basic Techniques in Environmental Simulation*, by Lt. Col. Roger C. Whiton and Capt. Emil M. Berecek, July 1982, 144pp. Environmental simulation modeling defined as the generation of synthetic weather observations and forecasts by use of mathematical/statistical models. Basic concepts in environmental simulation modeling are described, with emphasis on underlying statistical

fundamentals, stochastic processes, and Markov processes. Four principle environmental simulation models and their application described in detail. Treatment begins with the single-variable, single-station model, V1S1, and is extended to the two-variable, single-station model V2S1. The multivariate triangular matrix model, Multri, is then discussed; that model is capable of generating vectors of a correlated variables. Case study presented showing application of Multri to modeling point sky cover distributions at station pairs or at a single station for n lag times. Most complex model in the series of four is the 2-dimensional field simulation model, 2DFLD, capable of producing spatially correlated, synthetic, two-dimensional fields or networks or variables. Statistical methods used in developing environmental simulation models are described, with particular emphasis on how to fit probability distribution functions to weather variables.

USAFETAC/TN-82/005 (AD-A123280) *The Theory and Use of a Raytracing Model Developed at USAFETAC*, by Capt. Michael D. Abel, Maj. John D. Mill, and Capt. Charles T. Linn, September 1982, 102pp. Describes the theory and use of the USAFETAC ray trace model (RAYTRA). In this model, atmospheric refraction is calculated using geometric optics and a single atmospheric profile. This program allows the user to define an arbitrary path geometry in the atmosphere anywhere from the earth's surface to space. In its present form ionospheric effects are ignored. Its use is restricted to frequencies between 30khz (wavelength 10 km) and 1,500 hz (wavelength 0.2 m). For frequencies between 115 ghz (wavelength 0.25 cm) and the (wavelength 20m), model results should be accepted with caution. The model itself is unique in its flexibility of application and special numerical techniques which enable it to compute types of ray paths which some models cannot handle. Furthermore, the code is structured in a modular, "top down" fashion to allow for ease in modification and program maintenance. It has the capability to utilize user input atmospheric data or data from USAFETAC archived weather tapes. Actual ray plotting is not provided. Instead, added information on the net atmospheric refractive effect such as range error is included in output along with a summary of input variables.

USAFETAC/TN-82/006 (AD-A123352) *Atmospheric Transport and Dispersion Model: User's Manual*, by 1st Lt. Robert M. Cox, October 1982, 22pp. The atmospheric transport and dispersion model (ATAD) is

oriented to transport and dispersion studies. It can calculate trajectories of 5-days' duration either forward or backward in time at 6-hour intervals during any selected period for any number of requested locations. The individual trajectories are calculated using transport winds averaged in a vertical layer. There are various optional and standard output characteristics. They include tables of transport layer depth, maximum vertical wind shear, trajectory positions, trajectory plots, and surface air concentrations. This program developed for IBM 4341 computer with OS operating system.

USAFETAC/TN-82/007 (AD-A130207) *Atlas of Mean Sea-Level Pressure*, by Maj. Henry A. Chary, November 1982, 207pp. An atlas of quarter-hemispheric maps of mean sea-level pressure and standard deviation. Maps based on 6-year period of record 1973-1978. Development of data base used briefly discussed. Maps are based on the UAPIP data derived from summarized AFGWC upper-air analysis.

USAFETAC/TN-83/001 (AD-A132186) *An Aid for Using the Revised Uniform Summary of Surface Weather Observations (RUSSWOs)*, June 1983, 69pp. Note designed to acquaint forecasters, primarily at detachment level, with the use of the RUSSWO prepared by USAFETAC. Includes brief explanation of each part of the RUSSWO, together with reproductions of selected summaries. Exercises that stress procedures for extracting key climatic data included for each reproduced climatological data summary. Some exercises introduce techniques for obtaining data not tabulated directly in the RUSSWO.

USAFETAC/TN-83/002 Not used.

USAFETAC/TN-83/003 (AD-A168056) *Ceiling/Visibility Simulation Model, Analysts's Manual*, by Maj. Emil M. Berecek, December 1983, 120pp. Describes a ceiling/visibility simulation model (WEASIM), designed to be a resident weather simulator within larger host simulation models. The model generates synthetic ceiling and visibility observations at multiple locations. WEASIM preserves the unconditional probabilities of occurrence of ceiling and visibility, as well as the temporal, spatial, and cross-variable correlations. The ceiling/visibility simulation model is "tuned" to a particular geographic area by inputting modeling coefficients and correlation parameters specifically determined from observed weather data from that area.

USAFETAC/TN-83/004 (AD-B082564) *User's Manual for Estimating Target Acquisition Range when Employing TV Sensors*, by Capt. Michael D. Abel, Capt. Dennis P. Regan, Charles J. Glauber, Lt. Kenneth J. Compton, and Lt. Robert M. Cox, December 1983, 390pp. A users guide for estimating the maximum acquisition ground range from TV sensor to target by manual method. Guide includes background information on visual contrast transmittance, a sample maximum ground range worksheet, and 13 directions for use. Also includes tables of reflectance values and many other aids needed to complete worksheet. Contains 360 pages of contrast transmittance charts plotted by ground range and night altitude.

USAFETAC/TN-83/005 (AD-B080261) *Ceiling/Visibility Simulation Model, Programmer's Manual*, by Maj. Emil M. Berecek, December 1983, 148pp. Describes source code for the ceiling/visibility simulation model (WEASIM). WEASIM designed as a resident weather simulator within larger host simulation models. The weather model generates synthetic observations of ceiling and visibility at multiple locations. WEASIM preserves the unconditional probabilities of occurrence of ceiling and visibility, as well as the temporal, spatial, and cross-variable correlations. The ceiling/visibility simulation model is "tuned" to a particular geographic area by inputting modeling coefficients and correlation parameters specifically determined from observed weather data from that area.

USAFETAC/TN-85/001 (AD-A160144) *Low-Level Wind Systems in the Warsaw Pact Countries*, by Wayne E. McCollom, Kenneth R. Walters, Ronald W. Coyle, Capt. Eleanor L. Smith, and TSgt. George E. Elder, March 1985, 56pp. A comprehensive survey of local, low-level wind systems in the Warsaw Pact and adjacent NATO/neutral countries. Region surveyed divided into two geographical areas that cover most of Europe. Local winds named, described, and related to meteorological definitions. Distinctive wind characteristics identified for specific local winds or their locale. Maps showing distribution and locations of local wind systems included. Extensive lists of locally named winds and descriptions. Includes figures, bibliography, and mathematical solution of mountain or standing wave lengths.

USAFETAC/TN-85/002 (AD-159989) *Central American Climatology*, by T. Jonathan Whiteside, USAFETAC/OL-A, Asheville, N.C., April 1985, 162pp.

A presentation of climatological information for the Central American region from Guatemala and Belize southward through Panama. Includes narrative descriptions of Central American climate and weather, to include major synoptic features, precipitation, psychrometric, cloudiness, visibility, surface winds, thunderstorms, fog, and haze. Also includes astronomical, tidal, and seismic data, along with contoured climatological charts and climatological data tables. Primarily addresses surface weather data, but includes some upper atmospheric data.

USAFETAC/TN-85/003 (AD-B099413L) *Electro Optical/Meteorological Simulation Model*, by Capt. Jack R. Stickel, Det. 4, 11th WS, August 1985, 173pp. Describes results of a pilot study to simulate electrooptical and meteorological variables; based on the NATO Optical Atmospheric Quantities in Europe (OPAQUE) project. The EO/MET simulator generates simultaneous synthetic measurements of visual attenuation, visual extinction, infrared transmittance, cloud cover, wind speed, relative humidity, temperature, dew point, and aerosol infrared extinction. The study involved two distinct steps: (1) A data study to investigate the underlying probability distributions, serial correlation, and cross-correlations of key weather and electrooptical variables, and (2) Building and testing a simulation model based on the results of the data study. Data analysis includes both raw and derived variables. *Distribution authorized to U.S. government agencies only, foreign government information, 27 November 1985. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.*

USAFETAC/TN-85/004 (AD-B099412L) *Central American Flying Weather*, by Kenneth R. Walters, December 1985, 18pp. A summary of flying weather in Honduras, El Salvador, Nicaragua, and Costa Rica, prepared by a meteorologist from interviews with highly experienced civil and military pilots and meteorologists in Honduras and Costa Rica. Flying weather in defined areas is described for each of the climatological seasons—seasons that do not necessarily match calendar seasons or North American temperate zone seasons. The author drew upon pilot/forecaster interviews, USAFETAC/TN-85/002, and his own 30 years' experience as an aviation meteorologist in preparing this report. Primary emphasis, however, was on the interviews.

USAFETAC/TN-86/001 (Revised) (AD-A218073) *Author-Editor Guide to Technical Publications Preparation*, by George M. Horn, September 1986, 52pp. Revised January 1990. A guide for authors and editors of AWS technical publications. Summarizes technical publications standards to give specific guidance on manuscript preparation, editing, and publication. Discusses overall technical publication process in DoD and AWS. Describes DoD document distribution limitations, tells how to determine limitations and mark documents. Includes sections on "The Words" and "The Numbers," along with summarized rules for punctuation and word compounds. Bibliography.

USAFETAC/TN-86/002 (AD-A174247) *Optimum Period of Record*, by Ronald Rodney, USAFETAC, OL-A, July 1986, 26pp. Percentage frequency of occurrence of ceilings and visibilities (as well as monthly means of temperature, precipitation, and pressure) is examined for relative and representative application to current climatology. Several U.S. and overseas locations showed climatological changes that rendered normals ineffective as tools for describing or predicting current weather conditions. Monthly values compared to running means for 1 to 31 antecedent years. Mean closest to actual value tallied as "best." This scoring system applied to periods of record beginning as early as 1700s, usually showed that shorter means (1 to 7 years) were frequently closer to actual values.

USAFETAC/TN-86/003 (AD-B130894) *Directory of Climatic Databases Available from OL-A, USAFETAC*, superseded by AFCCC/TN-96/001.

USAFETAC/TN-88/001 (AD-B128952) *A Descriptive Climatology for BaléDogle, Somalia*, by Kenneth R. Walters, Sr., January 1988, 23pp. A descriptive climatology study for the summer season (June, July, August), at BaléDogle (also Ballie Doogle), Somalia, east central Africa. Local forecasting applications and suggestions are included. This study was prepared by combining the resources of the Air Force Weather Technical Library (AFWTL) and the worldwide USAFETAC weather observation database with a limited series of weather observations taken in place.

USAFETAC/TN-88/002 (AD-B124124) *The Persian Gulf Region—A Climatological Study*, by Kenneth R. Walters, Sr. and Capt. William F. Sjöberg, May 1988. A climatological study of the Persian (or Arabian) Gulf,

the Strait of Hormuz, the Gulf of Oman, and their adjacent land areas, including Iraq, Iran, Kuwait, Bahrain, the United Arab Emirates, and Oman. Describes general geography of the area. Discusses "semipermanent climatic controls" and "transitory synoptic features" for each of four climatological regimes or seasons: the northeast monsoon (December-March), the spring transition (April-May), the southwest monsoon (June-September), and the fall transition (October-November). Discusses "mesoscale synoptic features," "typical weather," and "sea surface conditions" for each of these seasons as they affect each of four climatologically similar subregions of the Persian Gulf.

USAFETAC/TN-88/003 (AD-B119239) *Persian Gulf Transmittance Study in the 8-12 Micron Band*, by Capt. Patrick M. Condray and Maj. Roger T. Edson, February 1988, 34pp. LOWTRAN6 was used to compute climatologies of atmospheric transmittance in the 8-12 micron frequency band for 12 stations in the Persian Gulf area over 4- to 10-year periods of record, depending on data availability. A standard geometry of 125 meters (410 feet) AGL sensor height and a 4 km (2.16 mile) slant range was assumed. The 12 stations were combined into four different regions, each with distinct climatological transmittance features. The four regions are: High Desert, Low Desert, Persian Gulf Coast, and Gulf of Oman. Results appeared to be directly related to monthly mean dew points (absolute humidity). There was some diurnal dependence in the data for most regions, with a minimum mean transmittance in the morning; the exception was in the Gulf of Oman region, which showed almost no diurnal change during the southwest monsoon. Unlike similar studies done in the mid-latitudes, where precipitation and fog events are more frequent, the relative frequency of occurrence for bad to good transmittance values was generally unimodal. *Distribution authorized to U.S. government agencies and their contractors only, critical technology, January 25, 1988. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002. WARNING—this document contains technical data whose export is restricted by the Arms Control Act (Title 22, U.S.C., Sec 2751 et seq) or the Export Administration Act of 1979, as amended (Title 50, U.S.C., App. 2401, et seq). Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with the provisions of AFI 61-204.*

USAFETAC/TN-88/004 (AD-B130895) *The Persian Gulf Region—A Refractivity Study*, by Capt. Robert H. Farrell, Jr., November 1988, 210pp. A descriptive climatology of atmospheric refractivity in the Persian Gulf, prepared from USAFETAC's upper-air climatic database. Climatologies are provided by season and by hour. Actual climatologies are preceded by a review of refractivity theory, a discussion of the meteorology of anomalous propagation, and an explanation of the presentation. *Distribution authorized to U.S. government agencies and their contractors, administrative or operational use, 13 September 1988. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.*

USAFETAC/TN-88/005 (Revised) (AD-A263173) *Seasonal Snowfall Statistics for Selected Stations*, revised by SSgt. Debra L. Runyon in January 1993, 36pp. A convenient reference to snowfall statistics at 63 selected stations worldwide. Revised data is for the 10-year period from 1980 to 1990. Total snowfall amounts for each season (defined as July of one year to June of the next) is provided, along with 24-hour snowfall extremes and dates. Seasonal means and standard deviations also given. All values in inches.

USAFETAC/TN-88/006 (AD-A203969) *Global Snow Depth Climatology*, by Dudley J. Foster, Jr., and Robert D. Davy, October 1988, 49pp. Describes the USAF Environmental Technical Applications Center's (USAFETAC's) Global Snow Depth Climatic Database; tells how the database was created and how it can be updated. Also tells potential users of the Snow Depth Database how to order data. Contoured charts that show mean mid-month snow depths for September through June in North America, Europe, and Asia are included in an appendix.

USAFETAC/TN-89/001 (AD-A205212) *Modeled Ceiling and Visibility (MODCV)*, by Capt. James T. Kroll and Capt. Harold A. Elkins, 25pp. Describes USAFETAC's Modeled Ceiling and Visibility (MODCV) computer program. Explains how cumulative distributions of ceiling and visibility are modeled with Weibull and reverse Weibull curves, which are used to produce unconditional probabilities and, with an Orstein-Uhlenbeck process, conditional climatologies for ceiling, visibility, and joint ceiling and visibility. Output is in tabular format by category and time lag.

USAFETAC/TN-89/002 (AD-B130896) *CVOF (Ceiling and Visibility Observation and Forecast) Program Users Guide*, by 1st Lt John A. Rupp, February 1989, 35pp. A users guide for USAFETAC's Ceiling and Visibility Observation and Forecast (CVOF) simulation model. CVOF was developed (as a weather submodel) for the Air Force Center for Studies and Analysis (AFSCA), which used CVOF in its larger host model, TAC THUNDER. CVOF is an upgrade of an earlier ceiling and visibility simulator called WEASIM I; CVOF produces observations and forecasts, while WEASIM I was only capable of observations. CVOF uses the four-dimensional sawtooth wave model to produce a synthetic observation and forecast of ceiling and visibility at each user-specified time step. Appendices provide examples of the three required input files.

USAFETAC/TN-89/003 (AD-A22267) *The Caribbean Basin—A Climatological Study*, by Kenneth R. Walters, Sr., 1st Lt. Andrew G. Korik, and 1st Lt. Michael J. Vojtesak, December 1989, 342pp. A climatological study of the Caribbean Basin, an area that includes Central America, the West Indies, and northern South America. After describing the general geography of land areas in the Caribbean Basin, the report discusses major meteorological features of the entire study area. The geography and major climatic controls in each of the three major regions that constitute the Basin are discussed, and each major region is broken into several subregions of "climatic commonality." Finally, the four so-called "seasons" in each of these subregions are discussed in considerable detail, with sections on "semipermanent climatic controls," "mesoscale and local effects," and "typical weather."

USAFETAC/TN-89/004 (AD-B135616) *The Caribbean Basin—An Electrooptical Climatology for the 8-12 Micron Band, Volume I—Central America*, by Capt. Patrick M. Condray and Maj. Roger T. Edson, July 1989, 159pp. A report on a comprehensive electrooptical climatology study for Central America. The study was developed by combining important "conventional" weather elements (clouds, precipitation, and fog) with climatologies of atmospheric transmittance in the 8-12 micron band. The transmittance climatologies were computed by the LOWTRAN6 computer model, using 21 stations with periods of record that varied from 6 to 14 years. A standard geometry of a 12.5-meter (410-foot) AGL sensor height and a 4-km (2.16-NM) slant range with a cloud-free line-of-sight were assumed for

the transmittance calculations. The 21 stations used were combined into seven regions, each with its own distinctive electrooptical climatology. The seven regions are the Yucatan Plains, the Western Yucatan, the Central American Mountains, the Caribbean Coastal Plain, the Pacific Coastal Plain, the Nicaraguan Lakes, and Eastern Panama. As noted in earlier transmittance studies, the most important single influence on transmittance is the variation in mean absolute humidity. Local topography is also an important influence, setting up local effects (such as orographic lift and land-sea breezes) that change the diurnal variation of transmittance from region to region. Humid sea breezes, for example, lower afternoon transmittances near seacoasts while inland conditions improve when there is convective mixing with drier air aloft. At times, favorable transmittance conditions are observed with unfavorable low ceilings, and vice-versa. ***Distribution authorized to U.S. government agencies and their contractors, critical technology, May 1989. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.***

USAFETAC/TN-89/005 (AD-B137470) *The Caribbean Basin—An Electrooptical Climatology for the 8-12 Micron Band, Volume II—The West Indies*, by Maj. Roger T. Edson and Capt. Patrick M. Condray, August 1989, 139pp. A report on a comprehensive electrooptical climatology study for the West Indies. The study was developed by combining important "conventional" weather elements (clouds, precipitation, and fog) with climatologies or atmospheric transmittance in the 8-12 micron band. The transmittance climatologies were computed by the LOWTRAN6 computer model, using 21 stations with periods of record that varied from 4 to 14 years. A standard geometry of a 125-meter (410-foot) AGL sensor height and a 4-km (2.16-NM) slant range with a cloud-free line-of-sight were assumed for the transmittance calculations. The 21 stations used were combined into six regions, each with its own distinctive electrooptical climatology. The six regions are: Northwest Cuba, Caribbean Open Waters, Greater Antilles Windward, Greater Antilles Leeward, Lesser Antilles, and Trinidad/Tobago. As noted in earlier transmittance studies, the most important single influence on transmittance is the variation in mean absolute humidity. Local geography is also an important influence, setting up local effects (such as orographic lift and land-sea breezes) that change the diurnal variation of transmittance from region to region. The consistent trade wind now produces windward and

leeward effects on mountainous islands, with more precipitation and slightly higher absolute humidities producing lower transmittances on the windward sides. At times, favorable transmittance conditions are canceled by unfavorable ceilings, and vice-versa. ***Distribution authorized to U.S. government agencies and their contractors, critical technology, May 1989. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.***

USAFETAC/TN-89/006 (AD-B144538) *The Caribbean Basin—An Electrooptical Climatology for the 8-12 Micron Band, Volume III—Northern South America*, by Maj. Roger T. Edson and Capt. Patrick M. Condray, December 1989, 250pp. A report on a comprehensive electrooptical climatology study for northern South America. The study was developed by combining important "conventional" weather elements (clouds, precipitation, and fog) with climatologies of atmospheric transmittance in the 8-12 micron band. Transmittance climatologies were computed by the LOWTRAN6 computer model, using 30 stations with periods of record that varied from 4 to 14 years. A standard geometry of a 125-meter (410-foot) AGL sensor height and a 4-km (2.16-NM) slant range with a cloud-free line-of-sight were assumed for transmittance calculations. The 30 stations used were combined into 12 regions, each with its own distinctive electrooptical climatology. The 12 regions are: the Colombian Caribbean Coast, the Venezuelan North Coast, the Lake Maracaibo Basin, the Venezuelan Andes, the Orinoco River Basin, the Guyana Coastal Plain, the Guyana and Colombian Highland, the Andes Mountains, the Colombian Pacific Coast, the Equadorian Pacific Coast, the Eastern Amazon Basin, and the Western Amazon Basin. As noted in earlier transmittance studies, the most important single influence on transmittance is the variation in mean absolute humidity. The seasonal shifting of the mean trough position (monsoon trough west of the Andes, equatorial trough east of the Andes) is an important influence that drives the seasonal wet/dry cycle (which varies from region to region) and brings lower transmittances through enhanced rainfall and higher absolute humidities. At times, favorable transmittance conditions are canceled by unfavorable ceilings, and vice-versa. ***Distribution authorized to U.S. government agencies and their contractors, critical technology May 1989. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.***

USAFETAC/TN-89/007 (AD-A234993) *The Caribbean Basin—A Refractivity Study*, by Capt. Robert J. Farrell, Jr., December 1989. A climatology of atmospheric refractivity in the Caribbean Basin, prepared from USAFETAC's upper-air climatic database. Climatologies are provided by season and by hour. Actual climatologies (in the appendices) are preceded by a review of refractivity theory, a discussion of the meteorology of anomalous propagation, an explanation of the presentation scheme, and a summary of the climatologies.

USAFETAC/TN-90/001 (AD-A222574) *Conditional Climatology of Ap*, by Capt. Donald L. Wilson and Maj. Roger T. Edson, February 1990, 99pp. Documents a study of USAFETAC's optical solar flare database and its relationship to Göttingen's planetary geomagnetic index (Ap). The study was based on solar flare data with an 11-year period of record (1975 to 1986—Solar Cycle 21). After solar flares and Ap indices were studied separately, more than 27,000 flare reports were merged with 3-hour Ap values for 7 days after each flare. The resultant dataset was analyzed with respect to certain flare characteristics (such as importance, brightness, duration, solar location, and phase of the solar cycle) to find the best predictor of geomagnetic storming. The results were summarized in contingency tables (provided in Appendix B) for use as solar forecasting aids. Some flares were found to have more of an influence on the earth's geomagnetic field than others. Of all the features studied, a flare's importance and location on the disk seemed to be the best predictors of geomagnetic storming.

USAFETAC/TN-90/002 (AD-A222094) *A LOWTRAN7 Sensitivity Study in the 8-12 and 34 Micron Bands*, by Capt. Patrick M. Condray, February 1990, 22pp. More than 750 runs of LOWTRAN7 were made to determine how variations in certain weather variables (absolute humidity, relative humidity, wind speed, meteorological range, and precipitation) affect computed atmospheric transmittance in the 8-12 and 3-5 micron bands. This was done by changing the value of each of these weather variables, in turn, and observing the resulting change in transmittance calculations. About 30 LOWTRAN6 runs were made for comparison with the LOWTRAN7 output. Results for the 8-12 micron band showed that absolute humidity and precipitation produce the greatest decreases in transmittance. When the desert aerosol is used in LOWTRAN7, high wind speeds can produce low transmittances due to heavy dust loading. Meteorological range only becomes a strong

factor in lowering transmittances when it drops below 2 km. Relative humidity is important when using the maritime aerosol, especially when it exceeds 70 percent.

USAFETAC/TN-90/003 (AD-A222266) *CLDGEN Users Guide*, by Capt. John A. Rupp, April 1990, 17pp. Tells how to use USAFETAC's Cloud Scene Generator (CLDGEN) computer subroutine. Explains capabilities and limitations of the subroutine, with instructions for installing and running it on the user's computer system. Output from the subroutine is used by a user-supplied host program to tabulate statistics on cloud effects.

USAFETAC/TN-90/004 (AD-A229375) *SWANEA (Southwest Asia-Northeast Africa)—A Climatological Study, Volume I—The Horn of Africa*, by 1st Lt. Michael J. Vojtesak, 1st Lt. Kevin P. Martin, and TSgt. Gregory Myles, June 1990, 242pp. The first in a four-volume series that describes the climatology of a region known as "SWANEA," an acronym for "Southwest Asia and Northeast Africa." Volume I describes a subregion of SWANEA known as "the Horn of Africa," an area that, for this study, has been divided into four other subregions of "climatic commonality." After describing the general geography of the Horn of Africa, the report discusses major meteorological features, including semipermanent climatic controls, synoptic disturbances, and mesoscale and local features. Finally, the four so-called "seasons" in each of the Horn's four climatically similar subregions are discussed in detail.

USAFETAC/TN-90/005 (AD-A229028) *Wet-Bulb Globe Temperature—A Global Climatology, October 1990 23pp*. Wet-bulb globe temperature climatology for three major areas of the globe (North and South America, Africa, and Asia) is provided as isolines plotted on four sets of charts for four months that represent the seasons in the northern and southern hemispheres.

USAFETAC/TN-91/001 (AD-A233009) *Glossary of AWS Acrinabs—Acronyms, Initialisms, and Abbreviations Commonly Used in Air Weather Services, January 1991 58pp*, by George M. Horn. A collection of acrinabs (acronyms, initialisms, and abbreviations) commonly used in the Air Force Air Weather Service. The acrinabs in this listing have been collected from a number of technical publications, journals, directives, and other glossaries. The collection is intended for use as a *decoding* device and should not be considered an authoritative source of spelling, exact meaning, or usage.

USAFETAC/TN-91/002 (AD-A232776) *SWANEA (Southwest Asia-Northeast Africa), A Climatological Study, Volume II The Middle East Peninsula*, revised by TSgt. Kenneth R. Gibson in September 1992, 263pp. This report (the second in a four-volume-series) is a climatological study of the Middle East Peninsula, an area that includes the Red Sea Coastal Plains, the Arabian Desert, the Fertile Crescent, and the Persian Gulf Coastal Plains. It was revised to include additional information acquired during the August 1990-March 1991 Persian Gulf War. After describing the general geography of land areas in the Middle East Peninsula, the study discusses major meteorological features of the entire study area. Each major subregion (based on "climatic commonality") is then broken into its own geography and general weather sections. Finally, each of the four so-called "seasons" in each of these subregions is discussed in detail.

USAFETAC/TN-91/003 (AD-240436) *SWANEA (Southwest Asia Northeast Africa), A Climatological Study, Volume III The Near East Mountains*, by Kenneth R. Walters, Sr., 1st Lt. Michael J. Vojtesak, Capt. Kevin P. Martin, TSgt. Gregory Myles, Michael T. Gilford, Capt. Kathleen M. Traxler, April 1991, 266pp. The third of four-volume series, this volume is a climatological study of the Near East Mountains: an area that includes Turkey (except for its Mediterranean and Aegean Sea coasts), Northern Iraq, Iran (except for its Persian Gulf and Arabian Sea coasts), Afghanistan, and Pakistan. After describing the general geography of land areas in the Near East Mountains, it discusses major meteorological features of the entire study area. Each major subregion (based on "climatic commonality") is then broken into its own geography and general weather sections. Finally, the four so-called "seasons" in each of these subregions are discussed in detail.

USAFETAC/TN-91/004 (AD-B159251) *Wet-Bulb Temperature Computation*, by Lt. Col. Roger C. Whiton, May 1991, 18pp. This technical note documents efforts by the USAF Environmental Technical Applications Center (USAFETAC) to develop an algorithm that would compute wet-bulb temperature from input pressure, dry-bulb temperature, and dew-point temperature. After testing, the algorithm was delivered to USAFETAC's Data Automation Branch for operational software development. It is recommended as a replacement for USAFETAC's defective WTBULB function.

USAFETAC/TN-91/005 (AD-A240437) *SWANEA (Southwest Asia Northeast Africa), A Climatological Study, Volume IV The Mediterranean Coast and Northeast Africa*, by 1st Lt. Michael J. Vojtesak, Capt. Kathleen M. Traxler, Michael T. Gilford, Capt. Kevin P. Martin, and SSgt. Gordon Hepburn, July 1991, 236pp. The fourth in a four-volume series, this volume is a climatological study of the Mediterranean Coast and Northeast Africa, an area that includes the coastlines of western and southern Turkey through Libya, plus the countries of Egypt, Libya, Chad, and Sudan. After describing the general geography of these areas, it discusses the major meteorological features of the entire study region. Each major subregion (based on "climatic commonality") is then broken into its own geography and general weather sections. Finally, the four so-called "seasons" in each of these subregions are discussed in detail.

USAFETAC/TN-91/006 (AD-A240457) *Conditional Climatology of Ap: The Relationship Between Various Solar Events (Surges, Prominences, Filaments, Radio Bursts, X-Ray Episodes) and Geomagnetic Storms*, by Maj. Donald L. Wilson, August 1991, 56pp. This report is a continuation of USAFETAC/TN-90/001, *Conditional Climatology of Ap-- The Relationship Between Solar Flares and Geomagnetic Storms*. Instead of focusing solely on optical flares as in the first study, this report documents the relationship between Göttingen's planetary geomagnetic index (Ap) and various other solar events, such as surges, prominences, filaments, radio bursts and x-ray events. The study is based on solar and Ap data with an 11-year period of record (1975 to 1986--Solar Cycle 21). Solar reports were merged with 3-hour Ap values for 7 days after each event. The resultant datasets were analyzed with respect to type, position on the sun, and size. Contingency tables of means and percent frequency distribution summarize the results.

USAFETAC/TN-92/001 Superseded by USAFETAC/TN-94/001.

USAFETAC/TN-92/002 (AD-B162288) *USAF-ETAC's Cloud-Scene Generator (CLDGEN) Model*, by Capt. John A. Rupp and Capt. Anthony J. Warren, January 1992, 46pp. Describes the USAFETAC Cloud-Scene Generator (CLDGEN) computer simulation model. The CLDGEN model, which simulates cloud scenes at given locations and times, interfaces with

software that tracks satellites in orbit. The model is intended for use in a wide range of cloud-free line-of-sight (CFLOS) applications. Report includes discussion of model theory and design, as well as the results of a validation study. ***Distribution limited to U.S. government agencies and their contractors, critical technology, 15 October 1991. Refer other requests to AFCCC/DOO, 151 Patton Ave., Room 120., Asheville NC 28801-5002.***

USAFETAC/TN-92/003 (AD-A248571) *Gulf War Weather*, by Kenneth R. Walters, Sr., Maj. Kathleen M. Traxler, Michael T. Gilford, Capt. Richard D. Arnold, TSgt. Richard C. Bonam, and TSgt. Kenneth R. Gibson, March 1992, 245pp. A daily history of weather that affected United States military operations from August 8, 1990 through March 31, 1991 in the conduct of the Persian Gulf War. Illustrations include weather satellite imagery of the study area, which comprised Saudi Arabia, Kuwait, Iraq, and areas immediately adjoining. Separate chapters describe the weather during Operations DESERT SHIELD, DESERT STORM, and PROVIDE COMFORT. Appendices summarize mean monthly temperatures (including wet-bulb globe and wind-chill temperatures) for selected stations in the study area.

USAFETAC/TN-92/004 (AD-A259541) *South America South of the Amazon River, A Climatological Study*, by Michael T. Gilford, 1st Lt. Michael J. Vojtesak, MSgt. Gregory Myles, TSgt. Richard C. Bonam, and Capt. David L. Martens, August 1992, 715pp. A climatological study of South America south of the Amazon River. The study area includes Brazil south of the Amazon, Peru south of 5 degrees south and south of the Marañon River, and the countries of Argentina, Bolivia, Chile, Paraguay, and Uruguay. It also includes the Falkland (Malvinas) Islands. After describing general geography, the report discusses the major meteorological features of South America. Next, the geography and major climatic controls of each of four major subregions (West Central, Tropical, Subtropical, and Southern South America) are discussed. Finally, each of the four subregions is broken into "zones of climatic commonality." "Seasons," which vary in each of these zones, are defined and discussed in considerable detail.

USAFETAC/TN-92/005 (AD-A260139) *Climatological Probability of Cloud-Free Line-of-Sight*, by Capt. Anthony J. Warren, December 1992, 31pp. This report describes how the climatological frequency

distribution of cloud-cover is obtained and used to compute the climatological probability of cloud-free line-of-sight, or CFLOS. The probabilities can be estimated for an instantaneous point in time or for a specified time window (i.e., the probability of a continuous CFLOS for a time period of t minutes). The procedures outlined in the report are used by the USAFETAC CPCFLOS computer program. An appendix describes the Burger Aerial Algorithm.

USAFETAC/TN-92/006 (AD-A260152) *Climate and Weather of the Horn of Africa Executive Summary*, by Kenneth R. Walters, Sr., and Capt. Richard D. Arnold, December 1992, 36pp. Provides a brief executive summary of annual weather and climatology for the region generally known as the "Horn of Africa," an area that comprises Somalia, Yemen, Djibouti, Ethiopia, Sudan, and Kenya.

USAFETAC/TN-93/001 (AD-A259841) *Somalia Upper-Air Climatic Atlas*, January 1993, 243pp. An atlas of tabular upper-air statistics for Somalia. Statistics are provided in three regional sets: Northern Somalia, Central Somalia, and Southern Somalia. Tables provide upper-air data (D-value, temperature, dew point, wind speed and direction) at levels from the surface to 10 millibars for specified 2.5 by 2.5 degree latitude/longitude grid points.

USAFETAC/TN-93/002 (AD-A263083) *Climate and Weather of Yugoslavia Executive Summary*, by Capt. Richard D. Arnold and Kenneth R. Walters, Sr., January 1993, 38pp. Provides a brief executive summary of annual weather and climatology for the region formerly known as Yugoslavia which, in 1992, was restructured politically into the countries of Slovenia, Croatia, Bosnia-Herzegovina, and Serbia.

USAFETAC/TN-93/003 (AD-A266850) *TAFVER II Users Manual*, by Capt. Christopher A. Donahue, May 1993, 31pp. TAFVER II is an automated quality control program designed to provide headquarters staff (at Hq USAF/XOW, Hq Air Weather Service, and the major command Directorates of Weather) a tool they can use to measure the quality of weather forecasting support provided by the Air Force weather community. The TAFVER II program, run by USAFETAC at Scott AFB, Ill., verifies all terminal aerodrome forecasts (TAFs) issued by Air Force weather forecasters, providing there are corresponding observations against which to verify them. TAFVER II accommodates customer-tailored

output by incorporating command-unique category thresholds. This technical note tells users how the TAFVER II program verifies weather forecasts and explains the output statistics. Appendices provide major command verification categories and USAFETAC's weather station information databases.

USAFETAC/TN-93/004 (AD-A269511) *Eastern Europe, A Climatological Study*, by Maj. Kathleen M. Traxler, et al., July 1993, 385pp. A climatological study of Eastern Europe, a region that comprises Poland, the Czech Republic, Slovakia, Hungary, Romania, the former Yugoslavia, Albania, Greece, Latvia, Lithuania, Estonia, Belarus, Moldova, Ukraine, Azerbaijan, Armenia, Georgia, and Turkey west of the Sea of Marmara; also Russia, Kazakhstan, Uzbekistan, and Turkmenistan west of 60 degrees east, including Novaya Zemlya. For this study, the entire region is divided into eight "zones of climatic commonality." Europe, the study discusses major meteorological features of the entire region. Geography and the major climatic controls for each of the eight "climatic commonality zones" are then described. Finally, each season is defined and discussed in considerable detail, to include typical weather, clouds, visibility, winds, precipitation, temperature, and weather hazards.

USAFETAC/TN-94/001 (AD-A275654) *Capabilities, Products, and Services of USAFETAC*, January 1994, 38pp. Superseded by AFCCC/TN-95/001.

USAFETAC/TN-94/002 (AD-A280923) *USAFETAC Online Climatology Dial-In Service Users Manual*, by MSgt. Robert G. Pena. Users of the USAF Environmental Technical Applications Center (USAFETAC) climatological database are permitted online access to selected portions of that database through a new telephone dial-in service. USAFETAC Dial-In uses a batch-type communication technique called "Advance Program-to-Program Communication (APPC)." Dial-In works cooperatively with Network Software Associates AdaptSNAAPPC to allow the flow of information between your computer and the USAFETAC mainframe. User hardware and software requirements include an IBM-compatible 286 or better PC with at least 640 K of main memory, 1.5 MB of available hard-disk space, MS-DOS version 3.2 or better, EGA display (256 K) memory, and a Hayes-compatible 2400-baud modem. A Microsoft-compatible mouse is highly recommended.

USAFETAC/TN-94/003 (AD-A283779) *North Korea--A Climatological Study*, by Kenneth R. Walters, Sr., and Maj. Kathleen M. Traxler, August 1994, 120pp. A climatological study of North Korea, also known as "The Peoples Republic of Korea." North Korea is separated from South Korea (The Republic of Korea) by the 38th Parallel. After a brief discussion of North Korea's geography and major meteorological features, the study describes the general and specific weather of North Korea, season by season. An appendix provides summarized climatological data for 17 weather stations in North Korea.

USAFETAC/TN-94/004 (AD-A283647) *Climate and Weather of Central Africa-Executive Summary*, by Kenneth R. Walters, Sr., and Maj. Kathleen M. Traxler, August 1994, 114pp. A brief executive summary that describes the weather and climatology of Central Africa, Rwanda, Burundi, and Zaire. For the purpose of this study, Zimbabwe (in southern Africa) has been included. Appendices provide summarized airfield weather data, paraprop weather, and cloud ceiling frequencies.

USAFETAC/TN-94/005 (AD-A289466) *Southern Africa--A Climatological Study*, by Maj. Kathleen M. Traxler, et al., December 1994, 217pp. A climatological study of Southern Africa, a region that comprises the Republic of South Africa, Zimbabwe, Namibia, Lesotho, Swaziland, Botswana, Madagascar, and the southern parts of Mozambique, Angola, Zaire, and Zambia. After describing the geography and major meteorological features of the entire study area, the study discusses the major climatic controls of each of Southern Africa's six "zones of climatic commonality" in detail. Each "season" is defined and discussed in considerable detail, to include general weather, clouds, visibility, winds, precipitation, and temperature.

USAFETAC/TN-95/001 (AD-A302315) *Equatorial Africa--A Climatological Study*, March 1995, by Capt. Christopher A. Donahue, Maj. Kathleen M. Traxler, Kenneth R. Walters, Sr., John W. Louer III, Michael T. Gilford, Capt. Michelle E. Edwards, MSgt. Joy L. Harding, TSgt. Richard C. Bonam, and SSgt. Scott A. Straw, 275pp. A climatological study of Equatorial Africa, a region that comprises Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Gabon, Congo, Central African Republic, Rwanda, Burundi, Uganda, Tanzania, Kenya,

Malawi, the southern parts of Mauritania, Mali, Niger, the northern parts of Angola, Mozambique, Zaire, and Zambia. After describing the geography and major meteorological features of the entire region, the study discusses the climatic controls of each Equatorial Africa's eight "zones of climatic commonality" in detail. Each "season" is defined and discussed in considerable detail, to include general weather, clouds, visibility, winds, precipitation, temperature and other hazards.

USAFETAC/TN—95/002 (AD-A302502) *Estimating Ice Accumulation on Surface Structures*, June 1995, by William R. Schaub, Jr, 33pp. Proposes several methods for estimating ice accretion on surface structures based on estimates of several atmospheric variables. Also provides information on types of structural icing, ice accretion theory, and ice accretion computer models.

USAFETAC/TN—95/003 (AD-A305627) *The Modeled Curves (MODCURVES) Program*, July 1995, by Capt. Thomas H. Elio, Capt. Anthony J. Warren, and Capt. Robert J. Falvey, 18pp. Describes USAFETAC's Modeled Curves (MODCURVES) computer program. Explains how Fourier analysis is used to model diurnal and annual curves of temperature, dew-point temperature, relative humidity, altimeter setting, and pressure altitude. Output is available in graphic or tabular format.

AFCCC/TN—95/004 (AD-A305466) *A Comparison of Aircraft Icing Forecast Models*, by Capt. Daniel Cornell, Capt. Christopher A. Donahue, and Capt. Chan Keith, December 1995, 40pp. Describes the results of a study that compared three operational algorithms for forecasting aircraft icing with actual pilot-reported icing. AFGWC's RAOB software was best, with 67 percent of type forecasts and 42 percent of intensity forecasts agreeing with pilot reports. The greatest degree of error was associated with forecasts of clear and mixed icing, and with moderate icing.

AFCCC/TN—95/005 (AD-A305463) *Capabilities, Products, and Services of the AFCCC (Air Force Combat Climatology Center)* December 1995, 40pp. A revision of USAFETAC/TN—94/001. Describes the capabilities of the Air Force Combat Climatology Center (AFCCC), an agency that creates, maintains, and applies the Air Force's climatological database. Describes database and AFCCC computer assets. Discusses AFCCC mission and organization. Appendices provide

request formats, Dian-In applications, and a history of AFCCC and military climatology. Superseeded by the following: <http://www.afccc.af.mil>.

AFCCC/TN—96/001 (AD-A304246) *Directory of Climatic Databases Available from OL-A, AFCCC*, by Phillip Clouse, and T. Jonathan Whiteside, January 1996, 38pp. A revision of USAFETAC/TN—86/003. A directory of climatic databases available from OL-A, AFCCC. Brief descriptions of each database give potential users enough information to determine which database meets their particular application requirements. Explains derivation, elements, geographic area, period of record, data set specifications, file size, update frequency, and quality control for each database. Provides users with references for obtaining more detailed information.

AFCCC/TN—96/002 (AD-A305431) *Nationwide Lightning Climatology*, by William R. Schaub, Jr., February 1996, 31pp. Documents lightning climatology developed by AFCCC for the CONUS. This climatology was developed from a database of cloud-to-ground lightning strikes that occurred from March through October 1986-90. Analysis of the lightning climatology showed that patterns of lightning strikes compared favorably with known preferred locations and times of thunderstorm development.

AFCCC/TN—96/003 (AD-A315321) *Lightning Climatology for Low-Level Flying Routes in the United States*, by William R. Schaub, Jr., March 1996, 35pp. Documents lightning climatologies developed by AFCCC for regions of the central and western CONUS. This climatology was developed from a database of cloud-to-ground lightning strikes that occurred from March through October during 1986-91. Analysis of the lightning climatology showed that patterns of lightning strikes compared favorably with known preferred locations and times of thunderstorm development. It also showed that stratification of the lightning climatologies by 700-mb wind directions is useful in revealing locations of lightning-strike patterns and their movements.

AFCCC/TN—96/004 (AD-A305686) *Lightning Climatology for Eglin AFB, Florida*, by Capt. Brian M. Bjornson, and William R. Schaub, Jr., March 1996, 36pp. Documents a climatology study AFCCC completed on the occurrence of lightning strikes at Eglin AFB, Fla. It depicts spatial and temporal variations in

lightning strikes expected with known thunderstorm patterns in the Eglin AFB area.

AFCCC/TN—96/005 (AD-A315324) *Lightning Climatology for Holloman AFB, New Mexico*, by William R. Schaub, Jr., March 1996, 28pp. Documents a climatology study AFCCC completed on the occurrence of lightning strikes at Holloman AFB, New Mexico. It depicts spatial and temporal variations in lightning strikes expected with known thunderstorm patterns in the Holloman AFB area.

AFCCC/TN—96/006 (AD-A315325) *Evaluation of the Homogeneity of Cloud Cover Climatology in Large Scale Regions*, by Capt. Anthony J. Warren, and Charles R. Coffin, March 1996, 28pp. Documents a study AFCCC completed to evaluate the homogeneity of cloud cover distributions within 19 regions known as Consolidated Evaluation Groupings (CEGs). The sizes of these CEGs vary widely and are composed of a variable number of smaller regions known as Post Mission Evaluation regions (PMEs). AFCCC computed the monthly cloud-cover frequency distribution for each of the CEGs and PMEs from the Air Force's Real Time Nephanalysis (RTNEPH) database. In addition, AFCCC conducted a statistical comparison of the PMEs within each CEG to measure the homogeneity of the cloud climatology.

AFCCC/TN—96/007 (AD-A315323) *Lightning Climatology for Maxwell AFB, Alabama*, by William R. Schaub, Jr., March 1996, 28pp. Documents lightning climatology developed by AFCCC for Maxwell AFB, Ala. This climatology was developed from a database of cloud-to-ground lightning strikes that occurred from March through October 1986-91. Analysis of the lightning climatology showed that patterns of lightning strikes compared favorably with known preferred locations and times of thunderstorm development. It also showed that stratification of the lightning data by 700-mb wind directions and K-index values is useful in revealing locations of lightning-strike patterns and their movement.

AFCCC/TN—96/008 (AD-A315322) *Lightning Climatology for Nellis AFB, Nevada*, by William R. Schaub, Jr., March 1996, 33pp. Documents a lightning climatology developed by AFCCC for Nellis AFB, Nev. This climatology was developed from a database of cloud-to-ground lightning strikes that occurred from March through October during 1986-91. Analysis of

the lightning climatology showed that patterns of lightning strikes compared favorably with known preferred locations and times of thunderstorm development. It also showed that stratification of the lightning data by 700-mb wind directions is useful in revealing locations of lightning-strike patterns and their movement.

AFCCC/TN—96/009 (AD-A315887) *Glossary of German Meteorology*, by Robert A. Van Veghel, May 1996, 52pp. Consists of a glossary of German words and terms related to meteorology and climatology. It is designed to assist meteorologists and climatologists in reading German or English bulletins and other weather-related text.

AFCCC/TN—96/010 (AD-A315336) *Maxwell Air Force Base Thunderstorm Study*, by Capt. Robert J. Falvey, June 1996, 34pp. Documents a study AFCCC completed to correlate various thunderstorm indices to the occurrence/non-occurrence of thunderstorms at Maxwell AFB, Ala. Eleven thunderstorm indices were used to determine statistically which, if any, of the indices could be used as predictors for occurrence/non-occurrence of thunderstorms. The discriminate functions were verified against an independent data set consisting of upper-air data from Centerville, Ala., and surface data from both Maxwell AFB, Ala., and Montgomery, Ala. Six different sets of classification tables based on probability thresholds were produced from the output of the discriminate functions. The regression equations developed are useful if they are used as a tool—not as a forecast. The unbinned modified sounding regression has high skill scores, a low false alarm rate, a low percent missed, and a high probability of detection.

AFCCC/TN—96/011 (AD-Pending) *Consolidated Statistical Background*, by Charles R. Coffin, November 1996, 118pp. This technical note is a compilation of several years' worth of background papers covering a wide range of topics in statistics. Many sample SAS procedures are also included.

AFCCC/TN—96/012 (AD-A315337) *Northwest Africa, A Climatological Study*, by Capt. Christopher A. Donahue, Capt. Luke D. Whitney, Kenneth R. Walters Sr., 2nd Lt. Kenneth P. Cloys, John W. Louer III, and MSgt. Charles D. Surls, August 1996, 126pp. A climatological study of Northwest Africa, including Algeria, Tunisia, Morocco, Western Sahara, and the

northern parts of Mauritania, Mali, and Niger. After describing the general geography of land areas in Northwest Africa, the major meteorological features of the entire study area are discussed. The geography and major climatic controls of each of the two "climatic commonality" regions that constitute Northwest Africa are outlined in separate chapters, with a detailed description of each "season," including typical weather, clouds, visibility, winds, precipitation, temperature, and additional hazards.

AFCCC/TN-97/001 (AD-A286960) *Southeast Asia, A Climatological Study*, by Maj Kathleen Traxler, Capt. Christopher A. Donahue, Capt. Luke D. Whitney, Capt. Michelle E. Edwards, Kenneth R. Walters, Sr., 2nd Lt. Kenneth P. Cloys, John W. Louer III, Melody L. Higdon, MSgt Joy L. Harding, MSgt. Charles D. Surls, and SSgt Scott A. Straw, May 1997, 268pp. A climatological study of Southeast Asia, including Cambodia, Laos, Myanmar, Malaysia, Thailand, and Vietnam. After describing the general geography of land areas, the major meteorological features of the entire study area are discussed. The geography and major climatic controls of each of Southeast Asia's six zones of "climatic commonality." Includes a detailed description of each "season," including typical weather, clouds, visibility, winds, precipitation, temperature and trafficability.

AFCCC/TN-97/002 (AD-A286961) *East Asia, A Climatological Study Volume I: Continental*, by Robert S. Lilianstrom, Melody L. Higdon, MSgt. Charles D. Surls, and MSgt Donald E. Carey, September 1997, 245pp. A climatological study of Tibet, Mongolia, and northwest China. After describing the general geography of land areas, the major meteorological features of the entire study area are discussed. The geography and major climatic controls of each of continental East Asia's three zones of "climatic commonality." Includes a detailed description of each "season," including typical weather, clouds, visibility, winds, precipitation, temperature, and hazards and trafficability.

AFCCC/TN-97/003 (AD-A286962) *East Asia, A Climatological Study Volume II: Maritime*, Capt. Luke D. Whitney, John W. Louer III, Robert S. Lilianstrom, Melody L. Higdon, MSgt. Charles D. Surls, John Freeman, Virgil Killman, and SSgt Gary D. Clinton, December 1997, 268pp. A climatological study of Tibet, Southeast and Northeast China, Taiwan, and Korea. After describing the general geography of land areas, the major meteorological features of the entire study

area are discussed. The geography and major climatic controls of each of maritime East Asia's four zones of "climatic commonality." Includes a detailed description of each "season," including typical weather, clouds, visibility, winds, precipitation, temperature, and hazards.

AFCCC/TN-00/001 (AD-Pending) *Eastern Siberia: The Maritime and Near-Maritime Regions*, Melody L. Higdon, Robert S. Lilianstrom, Virgil H. Killman, January 2000, 220pp. A climatological study of Eastern Siberia. This study concentrates on the maritime and near-maritime regions of Eastern Siberia. The region includes the continental northeastern coast and islands, the continental southeastern coast and islands, and extends from the Arctic Ocean to northernmost China. After describing the geography and major meteorological features of the entire region, the study discusses in detail the climatic controls of each of Eastern Siberia's "three zones of climatic commonality." Each "season" is defined and discussed in considerable detail with emphasis on general weather, clouds, visibility, winds, precipitation, temperature and hazards.

AFCCC/TN—00/002 (AD-Pending) *Central Siberia: North Central and South Central Siberia*, Melody L. Higdon, Robert S. Lilianstrom, MSgt Don Carey, January 2000, 156pp. A climatological study of Central Siberia. This study concentrates on the North Central and South Central regions of Central Siberia. After describing the geography and major meteorological features of the entire region, the study discusses in detail the climatic controls of each of Eastern Siberia's "two zones of climatic commonality." Each "season" is defined and discussed in considerable detail with emphasis on general weather, clouds, visibility, winds, precipitation, temperature, hazards, and trafficability.

AFCCC/TN-00/003 (AD-Pending) *Western Siberia: The West Siberian Plain and Central Asia*, Melody L. Higdon, Robert S. Lilianstrom, John Freeman, SSgt Gary Clinton, January 2000, 148pp. A climatological study of Western Siberia. This study concentrates on the Western Siberia Plain and Central Asia. After describing the geography and major meteorological features of the entire region, the study discusses in detail the climatic controls of each of Western Siberia's "two zones of climatic commonality." Each "season" is defined and discussed in considerable detail with emphasis on general weather, clouds, visibility, winds, precipitation, temperature, hazards, and trafficability.

3-3. AFGWC TECHNICAL NOTES. The OPR for AFGWC technical notes is AFWA/DNT, 106 Peacekeeper Lane, 2N3, Offutt AFB NE 68113-4039. Order AFGWC publications from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019. Note that some of these documents were designated "technical memos" (TMs) through 1978 even though the "TN" sequence began in 1971.

AFGWC-TM-69-1 (AD-701374) *A Data Selection Procedure for the Rectification and Mapping of Digitized Data*, by Maj. Richard C. Roth, December 1969, 27pp. Describes an automated method for rectification and mapping of meteorological satellite images or similar high-resolution data. Purpose of the procedure is to rectify and map satellite photos and spin scan data with the greatest possible accuracy.

AFGWC-TM-69-2 (AD-710203) *Fine Mesh Upper Air Analysis Model*, by Capt. Rex J. Fleming, December 1969, 22pp. Gives details of AFGWC fine mesh upper air analysis program, along with equations used to derive the first guess fields. Analysis techniques a method of successive corrections to the first-guess field. A variable scan radius maximizes details over dense data regions and minimizes unwanted irregularities over sparse data regions.

AFGWC-TM-69-3 (AD-717651) *Deviation Analysis*, by Maj. Thomas Kaneshige and Capt. Philip W. West, December 1969, 27pp. Describes the AFGWC Deviation Analysis Program that provides the mechanism for quality control of meteorological observations and gridded constant pressure analysis and forecast fields. Deviations between observed values and interpolated (in time and space) analysis and/or forecast values are used in the analysis program to detect significant errors in the analysis and forecast fields. Errors are shown to a monitoring analyst with a number of standard AFGWC displays that include window or hemispheric contoured charts and data lists. This procedure lets the monitoring analyst evaluate significant errors rapidly and make timely corrections.

AFGWC-TM-69-4 (AD-701375) *Evaluating Probability Forecasts*, by Maj. James S. Kennedy and Capt. Preston G. Epperson, December 1969, 13pp. The accuracy of an aggregate of probability forecasts involves two basic attributes called reliability and sharpness. By expanding the equation of the Brier-Allen Probability Score, consistent definitions of reliability and sharpness are derived in which the correlation coefficient between forecasts and outcomes has a key role. Presents a graphic means of comparing aggregates of probability forecasts.

AFGWC-TM-69-5 (AD-702449) *Tropical Wind and Temperature Analysis*, by Maj. August L. Shumbera, Jr., December 1969, 14pp. The AFGWC objective computer tropical wind and temperature analysis program produces gridded wind and temperature analyses from 850 to 50 mb. The analysis technique is the method of successive correction to a first guess field. First guess fields are derived from persistence, climatology and a "blending" of gridded data from the Northern Hemisphere upper air analysis program. Validated wind and temperature observations are used to correct the first-guess fields in the analysis. The correction formula effectively treats all aircraft observations over a small area as one composite observation and all fixed observations as another composite observation which prevents several aircraft observations from masking out an observation from a fixed station. A special technique is used to eliminate spurious divergence in the wind analyses. Errata sheet change, undated.

AFGWC-TM-70-1 (AD-709367) *AFGWC Meso-Scale Prediction Model*, by Capt. James Kerlin, March 1970, 21pp. Describes an upper-air numerical forecast model designed to compute 0-24 hour forecasts for a limited area (window) using a grid spacing. Boundary values are required from a hemispheric mode. This model is designed to obtain higher resolution in the description of atmospheric features smaller than those portrayed by conventional macro-scale numerical forecast models. It is used at the AFGWC to provide forecast data at the top level of the AFGWC boundary layer (1,600 meters above the terrain). The mesoscale prediction model is expandable to hemispheric applications.

AFGWC-TM-70-2 (AD-None) *AFGWC Macro-Scale Upper Air Analysis Model*, by Maj. August L. Shumbera, Jr., March 1970, 31pp. The AFGWC macroscale numerical upper air analysis program for the Northern Hemisphere is described. The program produces wind, height, and temperature analyses at 14 levels from 850 to 10 mbs, and moisture analyses at four levels, from 850 to 400 mbs. A detailed explanation of the derivation of first-guess fields is presented. The analysis technique is the method of successive corrections to a first-guess field. Constraints are applied to the stability of each layer.

Radiation corrections are applied above 100 mb to observations taken in daylight to remove instrumental errors.

AFGWC-TM-70-4 (AD-709368) *AFGWC Macro-Scale Baroclinic Prediction Model*, by Capt. Kenneth J. Palucci, March 1970, 18pp. A six-level quasi-geostrophic prediction model has been in use at AFGWC since 1965. It produces forecasts of wind, pressure-height, vertical velocity, stream function and temperature for up to 72 hours. Installation of a larger computer in 1968-1969 allowed significant changes in the model. Improvements include a refined smoothing technique, use of higher order terms in the calculation of vorticity advection, and the inclusion of a new wind computational technique.

AFGWC-TM-70-5 (AD-713058) *AFGWC Boundary Layer Model*, by Lt. Col. Kenneth D. Hadeen, April 1970, 60pp. Describes a limited area, seven-layer physical-numerical model for the lower tropospheric region. Grid interval is half that of the standard numerical weather prediction grid used in the hemispheric, free atmospheric operational model at AFGWC. This model is an integral part of the complete AFGWC mesoscale (sub-synoptic) numerical analysis and prediction system. It provides greater horizontal and vertical resolution in both the numerical analyses and numerical forecasts. It is used to predict the more detailed smaller scale atmospheric perturbations important in specifying sensible weather elements. Important features of this boundary layer model include the following: a completely automated objective numerical analysis of input data; the transport of heat and moisture by three dimensional wind flow (including terrain and frictionally induced vertical motions); latent heat exchange in water substance phase changes; and eddy flux of heat and water vapor.

AFGWC-TM-70-6 (AD-717652) *AFGWC Automated Meteorological Data Processing*, by Richard K. Wilson, September 1970, 86pp.

AFGWC-TM-70-7 (AD-None) *Turbulence Forecasting Procedures*, by Capt. Paul T. Burnett, December 1970, 86pp. Air Force Global Weather Central operational procedures are described for forecasting low-level mechanical, mountain wave- associated, and clear air turbulence significant to aircraft. These procedures involve both annual and automated diagnostic techniques for analyzing individual rawinsonde

soundings, data at constant pressure levels, and data from the AFGWC planetary boundary layer model. Brief outlines of computational procedures used in the computer diagnostic and prognostic programs are included. The basic forecast procedure is to associate reported turbulence and potentially turbulent areas with meteorological and orographic features, forecast the future positions of the meteorological features, and reassociate the turbulent areas. Forecasts of low-level mechanical turbulence rely to a considerable extent on prognoses of a numerical turbulence index. Index variables are the gradient level wind, vertical motion, low-level atmospheric stability, 3-hourly sea-level pressure change, and terrain roughness. Formation of mountain waves is forecast using an automated adaptation of the Harrison technique; it considers sea-level pressure gradients and wind data above the mountain range. Clear air turbulence (CAT) has been found to be largely associated with shallow baroclinic layers of smaller scale than can be accurately forecast within the present state of the numerical weather prediction art. Consequently, automated forecasts of wind, vertical motion, and temperature distribution and empirical indices incorporating these elements are assimilated by an experienced forecaster into the final prognosis.

AFGWC-TM-70-8 (AD-731138) *Validation of Meteorological Data*, by Lt. Col. Thomas Kaneshige and Capt. Bernard C. Diesen, September 1970, 41pp. The AFGWC computer programs for the validation of surface, aircraft and upper-air (RAOB, PIBAL, and ROCOB) reports are described. All reports received in standard codes from the DoD Automated Weather Network are subjected to a number of validation checks: timeliness, gross error, internal consistency, and deviation from a previous analysis or forecast. Failure to pass these checks can result in one of two actions: one or two elements may be discarded, or the entire report may be discarded. Validation of data from atmospheric soundings is discussed in detail. Examples are given to illustrate the methods used to determine whether upper-air height and/or temperature data are in error. Missing or garbled upper-air temperature and height data for mandatory reporting levels are recomputed by solving a system of two simultaneous equations. Procedures to merge newly validated data with similar data validated earlier are briefly described.

AFGWC-TM-70-9 (AD-717653) *Three-Dimensional Nephanalysis*, by Maj. Allen R. Coburn, March 1970,

53pp. The AFGWC objective three-dimensional nephanalysis program (3DNEPH) produces high resolution, three-dimensional analyses of clouds. A horizontal grid spacing of about 25 nautical miles is used. Analyses are for 15 layers from surface to 40,000 feet MSL, with higher vertical resolution near the surface (150-foot depth for layer 1) and lower vertical resolution at the top of the model (5,000-foot depth for layer 15). The problem is a stream of individual processors. The active processors are the following: surface data processor, radiosonde data processor, aircraft data processor, satellite video data processor, decision tree processor, final processor, and the special display processor. A description of each processor is given, along with some of the major decisions made within each processor.

AFGWC-TM-70-10 (AD-735741) *AFGWC Multilevel Cloud Model*, by Maj. Ralph W. Collins, December 1970, 43pp. Describes the mathematical formulation of the AFGWC cloud forecasting model. Model consists of three modules: macroscale clouds (MSC), five-layer (5LYR), and high-resolution cloud prog (HRCP). Forecasts are based on three-dimensional parcel displacements computed from forecast winds given by dynamic numerical weather prediction models.

AFGWC-TM-71-1 (AD-731196) *AFGWC Divergent Mesoscale Prediction Model*, by Capt. James Kerlin, June 1971, 25pp. Describes a follow-on improved mesoscale weather prediction model. Using the previously developed AFGWC mesoscale prediction model as a test-bed, a refined model was developed. Data initialization procedures were modified to separate stream function from the irrotational component of the wind, retaining the divergent portion of the wind field. The resulting field, used as input to the prediction model, more nearly reflects actual atmospheric conditions without introducing spurious noise detrimental to numerical forecasts. Undated change, 17pp.

AFGWC-TM-71-3 (AD-735742) *AFGWC Macro-Scale Update Forecast Model*, by Capt. James Kerlin, November 1971, 17pp. This model specifically designed to be compatible with the macroscale baroclinic prediction model that produces forecasts of height, wind, and temperature at six levels (850, 700, 500, 300, 200, and 100 mb) for an octagonal (hemispheric) grid. The update model produces 6- to 36-hour updated forecasts for window areas of 15x15 to 35x35 grid points (381 km spacing) that may be located anywhere within the

octagon. The model is employed whenever required to update areas of the hemispheric forecast that were initially so data-deficient as to significantly degrade the forecast. Stream functions are forecast at six levels and are used as input to solve the diagnostic omega equation, from which vertical velocities are obtained for solution of the vorticity equation for a new stream function tendency. The time step is 45 minutes. Horizontal boundary conditions are determined from the hemispheric forecasts being updated.

AFGWC-TM-71-4 (AD-736823) *AFGWC Forward Trajectory Model*, by Capt. Donald S. Thomas, December 1971, 16pp. Describes the AFGWC Forward Trajectory Model, a customer-oriented global parcel trajectory model. The global capability of this model is a result of the input global wind fields available in the AFGWC data base. The model computes forecast positions out to 72 hours for a parcel of air starting at any predetermined point and follows the parcel for up to 10 days. Each cycle provides the current position and forecast positions at each interval during the 10-day period. The customer has various options available concerning construction and use of the trajectories.

AFGWC-TM-72-1 (AD-743302) *A Modified Upstream Differencing Technique for Solving the Advection Equation*, by Maj. Lynn L. LeBlanc, April 1972, 51pp. A scheme for numerical modeling of advection of meteorological elements has been developed and is now used in AFGWC operational models. In this scheme, new values are determined at each time step for each grid point of the prediction matrix by first determining the upstream trajectory position at the previous time step and the corresponding parametric values, then modifying the grid point values. This quasi-Lagrangian advection scheme, which is inherently computationally stable, allows use of any reasonable time step and almost total elimination of artificial smoothing. This technique effects preservation of tight gradients and flow patterns with minimal distortion through the forecast period, as well as more realistic movement and retention of extreme parametric values of analyzed features.

AFGWC-TM-72-2 (AD-763102) *The AFGWC Macroscale Tropical Prediction Model*, by Capt. Douglas A. Abbott, December 1972, 31pp. Describes an upper-air numerical forecast model designed to predict tropical macroscale features. Model is based on conservation of potential vorticity as modified by terrain

and surface friction. Time-dependent lateral boundary conditions obtained from the AFGWC Northern and Southern Hemispheric macroscale forecasts are incorporated into the model. These boundaries are located at roughly 37 degrees north and 37 degrees south latitude. The quasi-geostrophic equations are used and are found to adequately describe the large scale tropical features. However, the use of these equations does not imply that tropical motions are quasi-geostrophic. Numerical integration employs a quasi-Lagrangian technique on a coarse mesh grid (5° latitude by 5° longitude at the equator) with a 3-hour time step. Numerical correction of planetary wave retrogression is unnecessary with this formulation. Given a reliable initial state, the model predicts wave evolution and phase displacement well. The model contains neither the physics nor the resolution to represent the cooperative interaction between the larger scale motion field and mesoconvective scale phenomena. In addition to predicting the large-scale tropical flow, the model makes available time-dependent boundary condition forecasts for use by limited area mesoscale prediction models and for both Northern and Southern Hemispheric macroscale models.

AFGWC-TM-73-1 (AD-774595) *AFGWC Macro-Scale Upper Air Analysis Model (Revised)*, by Capt. Dennis Moreno, October 1973, 28pp. Describes the AFGWC Macroscale Numerical Upper-Air Analysis Program for the Northern and Southern Hemispheres. The program produces wind, D-value, and temperature analyses at 14 levels from 850 mb to 10 mh, and moisture analyses at four levels from 850 mb through 400 mb. A detailed explanation of the derivation or first-guess fields is presented. The analysis technique is the method of successive corrections to a first-guess field. Constraints are applied to the stability of each layer.

AFGWC-TM-73-3 (AD-775362) *Tropical Analysis Model*, by Maj. James F. Brown, November 1973, 23pp. The AFGWC objective tropical computer analysis programs produce gridded surface pressure and temperature analyses, gridded computed temperature and D-value fields for 1,000 mb, temperature-dew point spread analyses 850-400 mb, and temperature, wind and D-value analyses 850-100 mb. First guess fields are derived from forecast/persistence. Validated observations used to correct first guess fields in the analysis. Special technique are used to insure vertical consistency.

AFGWC-TM-74-1 (AD-787210) *The Scan Plane Method for Locating and Gridding Scanning Radiometer Satellite Data*, by Capt. Terry L. Cherne, January 1974, 80pp. Describes improved techniques for locating and gridding meteorological satellite imagery data by automation. Overall objective is to relate each data sample to a location on a standard map projection so an automated mapping routine can manipulate data to build required product. To achieve objective, either particular data samples or particular map points were selected as bench points; calculations performed for only these points. Remaining points determined by interpolation.

AFGWC-TM-74-2 (AD-A005496) *Computer Flight Plan System*, by Charles W. Cook, January 1974, 65pp. Computer flight planning support for DoD activities provided by AFGWC. Computer flight plans generated from user specifications of flight path and aircraft characteristics. Route selection made by requester after evaluating both meteorological and non-meteorological variables affecting the flight. Route specifications may be supplied at the time of request or obtained from a library of predefined routes maintained at AFGWC. Flight plan system has two major components: The operational night data component accomplishes the collection, management, and accounting of all data necessary to specify the route, while the flight simulation model component simulates flight of the aircraft through the AFGWC data base.

AFGWC-TM-75-1 (AD-None) *The AFGWC Snow Cover Analysis Model*, superseded by AFGWC/ TN-86/001.

AFGWC-TM-76-1 (AD-A062344) *Jet-Stream Analysis and Turbulence Forecasting*, by Capt. Michael C. Holcomb, March 1976, 108pp. Summarizes synoptic techniques available for forecasting turbulence. Report based on Sorensen's classification scheme and later studies.

AFGWC-TM-76-2 (AD-A035651) *Forecast Guides Used for the Centralized Terminal Forecast Program*, by Maj. Arthur T. Safford III, December 1976, 465pp. Contains an organized discussion of synoptic weather types in the United States, a regional description of synoptic effects, and an individual station breakdown of local differences in these effects. Information compiled as a training pamphlet for new AFGWC forecasters. Extensive knowledge of local effects at

every station necessary for successful forecasting from a centralized facility. Document published for use by other AWS units as a training aid.

AFGWC-TM-78-001 (AD-A057126) *High Frequency Radio Users Guide to AFGWC Products*, by CMSgt. Edward D. Beard, January 1978, 25pp. High frequency (3-30 Mhz) radio waves used for long range communications networks are at the mercy of natural variations in the earth's upper atmosphere—more specifically, the ionosphere. This guide explains these variations and describes various products available from AFGWC that can alert system operators to observed or predicted solar and geophysical activity that can affect HF circuit reliability. Guide is basic and designed with the field communicator in mind, but contains information of value to circuit managers and supervisors.

AFGWC-TM-78-002 (AD-A057176) *The AFGWC Automated Cloud Analysis Model*, by Maj. Falko K. Fye, June 1978, 108pp. The AFGWC automated cloud analysis program (3DNEPH) produces high resolution, three-dimensional analyses of clouds over the entire globe. Up to eight analyses a day are scheduled, with additional limited area analyses available on request. Horizontal grid spacing is 25 NM and the vertical grid consists of 15 layers of varying thickness from the earth's surface to 55,000 ft MSL. The program is a string of individual modules that process and integrate meteorological cloud information from surface, pilot, and upper-air reports. An additional capability to interpret and incorporate visual and infrared satellite imagery results in high resolution, worldwide coverage. Recent advances in techniques for interpreting satellite imagery described. A new manual data input processor, quality control procedures, and applications also described. Appendix provides detailed information on the high resolution terrain, geography, temperature, and background brightness (albedo) fields used to support the model. A history of the model and detailed descriptions of the satellite processing algorithms are provided. Samples of displayed data are provided.

AFGWC-TM-78-003 (AD-A063648) *Point Analysis User's Guide*, by Capt. Paul T. Nipko and Capt. Randolph G. Arbeiter, September 1978, 80pp. The new point analysis (PA) process was developed to correct specific deficiencies in the previous process (AFGWC Point Analysis Documentation, 1 August 1974). These deficiencies, identified by the 3WW Point Analysis Conference in March 1976, fall into three general

categories. First, the moisture modeling technique had a deficiency of moisture through the tropopause. Second, there was a lack of observed density data for the 80- to 250-km region. Finally, the production process required an excessive number of manual tasks. The PA process uses a new tropopause moisture modeling technique; it includes, when available, rocketsonde observations; and it reduces the manual tasks to directing and quality controlling.

AFGWC-TM-78-004 (AD-A063882) *Environmental Effects on VLF Navigation Systems (Omega)*, by CMSgt. Edward D. Beard, December 1978, 32pp. Very low frequency (VLF, 3-30 Khz) radio waves are useful for long range navigation systems such as the Omega. Anomalies in the upper atmosphere, specifically in the ionosphere, can introduce significant errors into these systems. This document describes these anomalies and introduces AFGWC products that may help navigators use the system better.

AFGWC/TN-71-1 (DOO) (AD-737031) *AFGWC Severe Weather Verification*, by Lt. Col. Arthur Bidner, September 1971, 17pp. Explains purpose, data input, mechanics, and interpretation of AFGWC severe weather verification. Illustrates some of the problems associated with the uniqueness and complexity of severe weather verification. Includes sample of results.

AFGWC/TN-71-1 (DOCM) (AD-None) *Verification Data: AFGWC Macroscale Baroclinic Prediction Model*, by Capt. James Kerlin, July 1971 (revised July 1972), 31pp. Forecasts produced by the AFGWC Macroscale Baroclinic Prediction Model are compared with observations from rawinsonde sites. Monthly summaries are for March, April, and May 1971. Summaries include frequency distribution and error statistics for 12, 24, 36, and 48 hour forecast at 850, 500, 300, and 100 mb. Elements verified are temperature, D-value, and wind.

AFGWC/TN-71-2 (AD-728201) *Verification Data: AFGWC Limited Area Mesoscale Prediction Model*, by Capt. James Kerlin, July 1971, 24pp. Forecasts produced by AFGWC Mesoscale Prediction Model are compared with observational rawinsonde data from stations in North American verification window. Summaries for March, April, and May 1971 include frequency distribution and error statistics for 12- and 24-hour forecasts of temperature, D-value and wind at the 850, 700, and 500 mb levels.

AFGWC/TN-71-3 (DOCM) (AD-None) Verification Data: AFGWC Boundary Layer Model, by 1st Lt. Arnold L. Friend, July 1971, 12pp. Forecasts produced by AFGWC's Boundary Layer Model are compared with observations from surface stations as well as with gridded verifying analyses for the 600-meter level. Summaries include frequency distribution and error statistics for 12- and 24-hour forecasts of wind, temperature, D-value, and specific humidity for May.

AFGWC/TN-71-4 (DOCM) (AD-None) Verification Data: AFGWC Macroscale Cloud Model, by Capt. James Kerlin, July 1971, 55pp. Forecasts produced by the AFGWC Macroscale Cloud Model are compared with cloud and rawinsonde observations for the area of the North American NWP grid. Statistical summaries are included for March, April, and May 1971. Summaries include frequency distribution and error statistics for 12-, 24-, 36-, and 48-hour forecasts of total cloud coverage, as well as for temperature and dew point depressions at the 850-, 700-, 500-, and 300-mb levels.

AFGWC/TN-71-5 (DOCM) (AD-None) Verification Data: AFGWC 1,000-mb Macroscale Prediction Model, by Capt. James Kerlin, September 1971, 13pp. Forecasts produced by the AFGWC 1,000-mb Macroscale Prediction Model are compared with rawinsonde observations; monthly summaries are for March, April, and May 1971. These summaries include frequency distribution and error statistics for 12-, 24-, and 36-hour forecasts of temperature and D-value.

AFGWC/TN-71-6 (AD-728200) Verification Data Macroscale Baroclinic Prediction Model (June-September 1971), by Capt. James Kerlin, September 1971, 40pp. Forecasts produced by the AFGWC Macroscale Baroclinic Prediction Model are compared with observational data from rawinsonde sites. Monthly summaries are included for June, July, August, and September 1971. These summaries include frequency distribution and error statistics for 12-, 24-, 36-, and 48-hour forecasts at 850, 500, 300 and 100 mb. Elements verified are temperature, D-value, and winds.

AFGWC/TN-71-7 (AD-735738) Verification Data Limited Area Mesoscale Prediction Model (June-September 1971), by Capt. James Kerlin, September 1971, 43pp. Forecasts produced by the AFGWC Meso Scale Prediction Model are compared with observational rawinsonde data from stations within the North American verification window. Statistical summaries are

included for June, July, August, and September 1971. Summaries include frequency distribution and error statistics for 12- and 24-hour forecasts of temperatures, D-value, and wind at the 850-, 700-, and 500-mb levels.

AFGWC/TN-71-8 (AD-735739) Verification Data Macroscale Cloud Model (June-September 1971), by Capt. James Kerlin, 30pp. Forecasts produced by the AFGWC Macroscale Cloud Model are compared with observational cloud and rawinsonde data for the area of the North American NWP grid. Statistical summaries include June, July, August, and September 1971. Summaries include frequency distribution and error statistics for 12-, 24-, 36-, and 48-hour forecasts of total cloud coverage, as well as temperatures and dew point depressions at the 850-, 700-, 500-, and 300-mb levels for all months except July.

AFGWC/TN-71-9 (AD-735740) Verification Data 1000 mb Macroscale Prediction Model (June-September 1971), by Capt. James Kerlin, 19pp. Forecasts produced by the AFGWC 1000-mb Macroscale Prediction Model are compared with observational data from rawinsonde sites. Monthly summaries are included for June, July, August, and September 1971. These summaries include frequency distribution and error statistics for 12-, 24-, and 36-hour forecasts of temperature and D-value.

AFGWC/TN-72-1-1 (AD-None) Verification Data 1000 mb Macroscale Prediction Model (October-December 1971), by Sgt. Garry R. Buettner, 14pp.

AFGWC/TN-72-1-2 (AD-None) Verification Data Macroscale Baroclinic Prediction Model (October-December 1971), by Sgt. Garry R. Buettner, 33pp.

AFGWC/TN-72-1-3 (AD-None) Verification Data Limited Area Mesoscale Prediction Model (October - December 1971), by Sgt. Garry R. Buettner, 32pp.

AFGWC/TN-72-1-4 (AD-None) Verification Data Macroscale Cloud Model (October-December 1971), by Sgt. Garry R. Buettner, 26pp.

AFGWC/TN-72-1-5 (AD-None) Verification of North American Window Boundary Layer Model (September-December 1971), by Capt. Arnold L. Friend, 98pp.

AFGWC/TN-72-1-6 (AD-None) Verification of North American Window Boundary Layer Model (February-March 1972), by Capt. Arnold L. Friend, 51pp.

AFGWC/TN-72-1-7 (AD-None) *Verification Data 1000 mb Macro Scale prediction Model (January-March 1972)*, by Sgt. Garry R. Buettner, 14pp.

AFGWC/TN-72-1-8 (AD-None) *Verification Data Macro Scale Baroclinic Prediction Model (January-March 1972)*, by Sgt. Garry R. Buettner, 30pp.

AFGWC/TN-72-1-9 (AD-None) *Verification Data Macroscale Cloud Model (January-March 1972)*, by Sgt. Garry R. Buettner, 25pp.

AFGWC/TN-72-1-10 (AD-None) *Verification Data Limited Area Mesoscale Prediction Model (January-March 1972)*, by Sgt. Garry R. Buettner, 32pp.

AFGWC/TN-72-1-11 (AD-None) *Verification Data Macroscale Baroclinic Prediction Model (April-May 1972)*, by Sgt. Garry R. Buettner, 23pp.

AFGWC/TN-72-1-12 (AD-None) *Verification Data 1000 mb Macro Scale Prediction Model (April-May 1972)*, by Sgt. Garry R. Buettner, 11pp.

AFGWC/TN-72-1-13 (AD-None) *Verification Data Limited Area Meso Scale Prediction Model (April-May 1972)*, by Sgt. Garry R. Buettner, 23pp.

AFGWC/TN-72-1-14 (AD-None) *Verification of North American Window Boundary Layer Model (April-June 1972)*, by Capt. Arnold L. Friend, 72 pp.

AFGWC/TN-72-2-1 (AD-None) *Satellite Data Location Accuracy*, by Capt. Gerald J. Dittburner, 11pp.

AFGWC/TN-72-6-1 (AD-743304) *AFGWC Air Station Model*, by Maj. Richard L. Daye, 18pp. The Air Stagnation Model (ASM) developed at AFGWC is designed to provide air stagnation data to Air Force installations overseas where mesoscale data are available. Variables are derived from the AFGWC Boundary Layer Model data and the AFGWC Meso Scale Prediction Model data. Precipitation forecasts from the Macroscale Cloud Module (MSC) are also used. Since the BLM forecasts are only available through 24 hours, the 36-hour outlook uses data from the AFGWC Macroscale Baroclinic Prediction Model, the MSC, and the 1000-mb Prognostic Model. The techniques used in the ASM are similar to those used by the National Weather Service. The air stagnation data include mixing

depth, transport wind in the mixing layer, ventilation value in the mixing layer, meteorological stagnation index (MSI), times of maximum and minimum MSI and the maximum and minimum MSI.

AFGWC/TN-73-2 (AD-NONE) *An Evaluation of the AFGWC Air Stagnation Model Meteorological Parameters*, by Capt. A. Edgar Mitchell, 24pp. The AFGWC Air Stagnation Model (ASMI) compares favorably with National Weather Service (NWS) products for air stagnation guidance. Compared were the two meteorological variables of mixing height and transport wind from the ASM and MWS. A statistical analysis was made for 1200Z and 1800Z data from eleven sites throughout the United States. The ASM and MWS forecasts had nearly the same mean mixing height, but ASM heights were slightly lower, as expected. The mean afternoon mixing heights for the ASM and NWS forecasts are approximately equal. Daily errors in ASM mixing heights are for the same magnitude as those made by NWS. Accuracy of ASM forecast elements is roughly equivalent to total of the NWS model.

AFGWC/TN-73-6-1 (AD-None) *AFGWC Air Stagnation Model*, by Maj. Richard L. Daye, Capt. A. Edgar Mitchell, and Capt. Saba A. Lucus, 15pp. The Air Stagnation Model (ASM) developed at AFGWC provides air stagnation data to Air Force installations overseas where mesoscale data are available. Variables are derived from the AFGWC Boundary Layer Model (BLM) data and the AFGWC Mesoscale Prediction Model data. Precipitation forecasts from the Macroscale Cloud Module (MSC) are also used. Since the BLM forecasts are available only through 24 hours, the 36-hour outlook uses data from AFGWC's Macroscale Baroclinic Prediction Model, the MSC, and the 1000-mb Prognostic Model. Techniques used in the ASM are similar to those used by the National Weather Service (GROSS). Air stagnation data includes mixing depth, transport wind in the mixing layer, ventilation value in the mixing layer, meteorological stagnation index (MSI), times of maximum and minimum MSI, and the maximum and minimum MSI value.

AFGWC/TN-79/001(REV) (AD-A083099) *Clear Air Turbulence Forecasting Techniques*, by 1st Lt. David R. Lee, Capt. Roland B. Stull, and Maj. William S. Irvine, December 1979 (Revised February 1984), 81pp. A compilation of latest clear air turbulence (CAT) forecasting techniques used by AFGWC forecasters. Methods are relatively easy to follow. Over the past 9

years, the automated CAT routines have been totally replaced. Synoptic rules of thumb and model relationships are now better Understood and documented.

AFGWC/TN-79/002 (AD-A083125) *Training Guide for Severe Weather Forecasters*, by MSgt. Charlie A. Crisp, November 1979, 82pp. A detailed training guide designed for a forecaster's initial exposure to the AFGWC's severe weather function; details analysis procedures for all charts and prognostic tools available to the severe weather function. Significant severe weather variables are analyzed at the surface, 850 mb, 700 mb, and 500 mb levels. Additionally, the 850/500 mb thickness and maximum wind charts are examined. Also discussed are the severe weather parameters chart and the 12-hour surface pressure change chart. A detailed, step-by-step evaluation of a synoptic situation is presented, along with appropriate forecasts and verification data. Finally, automated prognoses available at AFGWC are discussed in relation to severe weather forecasting. Before using this guide, forecasters should become familiar with AWSTR 200 (Rev), *Notes on Analysis and Severe Storm Forecasting Of The Air Force Global Weather Central*. AWSTR 200 (Rev) is referred to briefly when relating analyzed variables to those synoptic patterns producing severe thunderstorms and tornadoes. This TN also familiarizes users with techniques used to produce the Military Weather Advisory (MWA). Multicolor illustrations. Note: Paper copies out of print and out of stock; DTIC microfiche in black and white only.

AFGWC/TN-79/003 (REV) (AD-A100324) *Map Projections and Grid Systems for Meteorological Applications*, by Capt. James E. Hoke, Capt. John L. Hayes, and 2nd Lt. Larry G. Renninger, March 1981 (Revised March 1985), 102pp. Describes maps and grids currently used at AFGWC to provide conventional meteorological support, but not those used for space environmental support. Emphasis is on equations needed for proper earth location of meteorological data on both maps and grids. Intended as a reference for programmers, but also provides information for users of AFGWC products and for the meteorological community at large. Addendum (four page inserts) June 1985.

AFGWC/TN-79/004 (AD-A083157) *The AFGWC Automated Analysis/Forecast Model System*, by Maj.

Terry C. Tarbell and Capt. James E. Hoke, December 1979, 59pp. Describes the AFGWC automated analysis/forecast model system. Emphasis is on interrelation of various analysis/forecast models in the production cycle. This description of the automated analysis/forecast system written for managers, programmers, computer operations personnel, product users, and the meteorological community at large. Only discusses analysis/forecast models that are primary meteorological data-base builders; most applications programs that access data bases not included.

AFGWC/TN-80/001 (AD-A087576) *SSH Moisture Sounding Interim Report*, by Maj. Richard C. Savage, March 1980, 23pp. Analysis of variance in the 18-30 micrometers water vapor sensing channels of the DMSP SSH infrared sounder shows that the channels are too opaque in moist atmospheres. Their statistical influence must be carefully controlled in forming statistical inversion matrices for temperature profiles.

AFGWC/TN-80/002 (AD-A088234) *Geomagnetic Index Calculation and Use at AFGWC*, by Capt. Robert D. Prochaska, April 1980, 34pp. AFGWC uses several geomagnetic indices to specify state of the magnetosphere. This paper introduces those indices of geomagnetic activity most commonly used by DoD agencies. Discusses procedures used at AFGWC to compute the indices and briefly describes uses for each.

AFGWC/TN-80/003 (AD-A090086) *The Use of Satellite-Derived Soundings in the AFGWC Stratospheric Analysis Models*, by Capt. Fred P. Lewis, Maj. Terry C. Tarbell, and Capt. James E. Hoke, August, 1980, 53pp. The first successful use of satellite-derived soundings in AFGWC's stratospheric analysis models was on December 26, 1979. A new procedure for construction of the stratospheric first-guess fields was also instituted on that date. These new first-guess fields are based on satellite soundings. This note describes changes to AFGWC's stratospheric analysis procedure.

AFGWC/TN-80/004 (AD-A094195) *Radiation Corrections Used in the AFGWC Stratospheric Analysis Models*, by Maj. Terry C. Tarbell and Capt. Francis G. Tower, September 1980, 21pp. At stratospheric levels, radiosonde temperature sensors are affected not only by ambient air temperature but by direct short-wave radiation and long-wave solar radiation. Short-wave radiation makes a radiosonde temperature

sensor indicate a temperature warmer than ambient air; long-wave radiation makes the sensor indicate a temperature cooler than ambient air. This note tells how corrections are applied to account for those radiation effects.

AFGWC/TN-81/001 (AD-A096833) *Short Term HF Forecasting and Analysis*, by Capt. James A. Manley, January 1981, 111pp. AFGWC's Space Forecasting Branch issues short term HF forecasts and analyses to a variety of users. This note gives forecasters some techniques for interpreting data used in preparing those forecasts, and describes forecast limitations.

AFGWC/TN-81/002 (AD-A100325) *Total Electron Content (TEC) Forecasting at AFGWC*, by Capt. James A. Manley, February 1981, 15pp. The AFGWC Space Forecasting Branch produces TEC forecasts for a variety of users. This note gives a qualitative assessment of TEC forecasts for a 5-year period.

AFGWC-TN-81/003 (AD-A130201) *Cloud/Clear/Snow Analysis Based on Satellite Data*, by Maj. Robert C. Woronicz, May 1981, 46pp. Describes an automated cloud/clear/snow analysis technique developed at AFGWC to evaluate performance of the Defense Meteorological Satellite Program (DMSP) Snow/Cloud Special Sensor (SSC). The evaluation showed that cloud/clear/snow areas could be analyzed with a high degree of reliability.

AFGWC/TN-82/001 (AD-A130202) *The Air Weather Service Primitive Equation Models. Part 1, The 6-Layer AWSPE Model. Part 2, The 7-Layer AWSPE Model*, by Maj. Terry C. Tarbell and Capt. Fred P. Lewis, May 1982, 63pp. Describes both AWS Primitive Equation (AWSPE) models in use at AFGWC. Gives brief history of AFGWC PE models and their forerunners at the National Meteorological Center. Gives technical details of both models.

AFGWC/TN-82/002 (AD-A138682) *Source Book of the Solar-Geophysical Environment*, by Maj. Ray E. Townsend, August 1982, 367pp. A text for the Space Environmental Support System (SESS) analyst and a reference for users of SESS products. Early chapters on physics, coordinate systems, and astronomy provide a brief review of important topics. Most of text deals with the solar-terrestrial system, with choice of topics driven

by operational considerations. Material intended to complement, not replace, current textbooks and journals dealing with solar-geophysics and astronomy.

AFGWC/TN-82/003 (AD-A135556) *Cloud Forecast Fields Comparison Test*, by Capt. Kenneth E. Mitchell, May 1982, 68pp. A study of comparative cloud forecast skill of several numerical analysis/forecast systems at AFGWC and National Meteorological Center. Study compares gridded cloud forecasts derived from AFGWC's trajectory cloud forecast model (5-layer) and NMC's 7-Layer moist primitive equation model (7LFHM) from August to September 1979. Study also measures sensitivity of 5-layer model to accuracy of input forecast winds (used to compute trajectories). Results show that 5-layer and 7LFHM-derived cloud forecasts differ appreciably owing to differences in methods used by the two centers to initialize model moisture fields. During first 24-hour forecast period, 5-layer consistently produces more accurate cloud forecasts than 7LFHM because satellite and surface cloud observations used systematically and globally in derivation of 5-layer initial moisture fields.

AFGWC/TN-86/001 (AD-A176202) *AFGWC Snow Analysis Model*, by Capt. Saba A. Lucas, Capt. James D. Martens, and Samuel J. Hall, February 1986, 26pp. Supersedes AFGWC-TM-75-1, same title, June 1975. The AFGWC Snow Analysis Model that generates daily snow age and depth analyses has been operational since March 1975 for Northern Hemisphere, since October 1975 for Southern Hemisphere. The snow analysis (SNODEP) model uses the latest surface synoptic observations, snow and ice climatology, time continuity, and manual updates, making it possible to produce very good measures of snow extent and reasonable snow depth values at all grid points over land and ice-covered areas of the earth, regardless of the availability of surface observations. The method of analysis, a technique used to infer snow age, is described, along with some problems associated with input data. Although the model is tailored to satisfy specific AFGWC requirements, other potential applications are discussed.

AFGWC/TN-86/002 (AD-A177931) *TAF Verification*, by Sherwin W. Jamison, November 1986, 32pp. Gives managers the information they need to use the Air Weather Service Terminal Aerodrome Forecast Verification (TAFVER) system effectively. The

TAFVER system provides a cost-effective means for monitoring terminal forecast performance reliability by retrieving terminal forecasts and comparing them with corresponding observations. Verification statistics are computed, retained, and periodically provided to management. Steps to help identify apparent and persistent problems are described.

AFGWC/TN-87/001 (AD-B115170) *AFGWC Cloud Forecast Models*, edited by Maj. Timothy D. Crum, April 1987, 78pp. This report describes the Air Force Global Weather Central's (AFGWC's) three cloud forecast models: Five layer (5LAYER), High Resolution Cloud Prognosis (HRCP), and Tropical Cloud Forecasting (TRONEW). These models satisfy a wide range of requirements and have been in operation since the early 1970s. Using a quasi-Lagrangian approach, the 5LAYER model makes extratropical forecasts for periods up to 48 hours. It produces forecasts of layer and total cloud, cloud type, layer temperatures, icing, and weather conditions. Trajectories needed for these forecasts are computed from wind forecasts derived from the AWS Global Spectral Model (GSM). The 5LAYER moisture is initialized from the Real-Time Nephanalysis (RTNEPH) model layer cloud amount and the Multilayer Analysis (MULTAM) model layer dewpoint depression. The 5LAYER temperatures are initialized from the High Resolution Analysis System (HIRAS) and GSM-derived temperatures. The High Resolution Cloud Prognosis (HRCP) model combines RTNEPH-analyzed cloud input with 5LAYER trajectories to produce high resolution (25NM) short-range (out to 9-hour) cloud forecasts. The TRONEW model uses the analyzed RTNEPH cloud to make 24-hour persistence cloud forecasts for the tropics. *Distribution authorized to U.S. government agencies only, critical technology, March 3, 1987. Other requests for this document shall be referred to HQ AFGWC/CV, 68113-5000.*

AFGWC/TN-88/001 (AD-B121615) *The AFGWC Automated Real-Time Cloud Analysis Model*, by 1st Lt. Raymond B. Kiess and Lt. Col. William M. Cox, March 1988, 91pp. Describes The Air Force Global Weather Central's RTNEPH (Real-Time Nephanalysis) automated cloud analysis model that replaced the older 3DNEPH model (3-Dimensional Nephanalysis) in August 1983. An older document (AFGWC TM 78-002) described AFGWC cloud analysis techniques of that time; the newer document preserves, as much as possible, the structure and content of its predecessor. *Distribution authorized to U.S. government agencies*

only, critical technology, 3 March 1987. Other requests for this document shall be referred to AFWA/DN, Offutt AFB, NE 68113-5000.

AFGWC/TN-90/001 (AD-A219309) *AFGWC's Upper Air Validator System*, by Paul A. Zamiska, February 1990, 25pp. Describes AFGWC's current Upper Air Validator System. Describes internal error checking and data quality assurance functions in detail. Problems with AFGWC's previous validator and improvements in the new one are addressed. Reject and suspect limits for temperature, height, wind speed, and density used by the validator are included.

AFGWC/TN-91/001 (AD-A235305) *Improved Point Analysis Model (IPAM) Users Guide*, February 1991, 201pp. The Air Force Global Weather Central (AFGWC) and the USAF Environmental Technical Applications Center (USAFETAC) have provided vertical meteorological profiles to military organizations, government agencies, and DoD contractors for a number of years. These products are called "Point Analyses," or "PAs." The contents of a PA let customers use applicable meteorological information to assess and evaluate their own data with respect to the state of the atmosphere at a specific place and time. The capabilities of the PA have recently been improved to accommodate new meteorological databases, new data sources, updated or new climatological data fields and models, and sophisticated mathematical techniques that enhance the accuracy and reliability of the data profile. The improved product is known as the "Improved Point Analysis Model," or "IPAM." This users guide describes the IPAM in detail, explaining its capabilities and limitations in sufficient depth to allow customers to use and apply the data to their own purposes.

AFGWC/TN-92/001 (AD-257985) *Computer Models Used by AFGWC and NMC for Weather Analysis and Forecasting*, by TSgt. Richard J. Conklin, August 1992, 77pp. Describes the numerical analysis and forecast models most widely used by U.S. Air Force Meteorologists. These models include the following: the Air Force Global Weather Central (AFGWC) Global Spectral Model (GSM), the AFGWC Real-Time Nephanalysis (RTNEPH), the AFGWC High Resolution Analysis (HIRAS) model, the AFGWC Five-Layer cloud forecast model (5-LAYER), the National Meteorological Center (NMC) Nested Grid Model (NGM), and the NMC Aviation/Medium Range Forecast (AVN/MRF) model. Report also describes model grids and tells how

the grids are built. Strengths and weaknesses of the models are discussed, along with AFGWC and NMC production cycles.

AFGWC/TN-93/001 Superseded by AFGWC/TN-95/001.

AFGWC/TN-95/001 Superseded by AFGWC/TN-95/002.

AFGWC/TN-95/002 (AD-A302303) *AFGWC Dial-In Subsystem (AFDIS) Software Users Manual, Version 3.2*, by Sterling Software, March 1995, 197pp. Describes AFGWC's Dial-In Subsystem (AFDIS) software (PC-0054; see Section 2.4) that allows remote access to certain applications of AFGWC's Satellite Data Handling System (SDHS). It provides users step-by-step instructions for installing and using the software required for access to SDHS. AFDIS software is *not* provided

with the users manual; to request software, call or write AFWA/DOO, 106 Peacekeeper Drive, Offutt AFB, NE 68113-4039, DSN 271-5985.

AFGWC/TN-95/003 (AD-A305627) Superseded by AFGWC/UH-96/001.

AFGWC/TN-95/004 (AD-Pending) *The Air Force Global Weather Central Surface Temperature Model*, by Thomas J. Kopp, PhD, December 1995, 30pp. Describes AFGWC's Surface Temperature Model (SFCTMP) mainframe computer program. Explains how it produces global temperature analyses and forecasts at and near the earth's surface. Explains the various processors used and the ties to other models, particularly the RTNEPH. Quality control and deficiencies are covered.

3-4. 1WW TECHNICAL NOTES. The 1st Weather Wing no longer exists, however, during its existence a number of technical documents were published. Questions on the following technical notes may be addressed to HQ PACAF/DOW, 25 E. Street, Suite 1232, Hickam AFB HI 96853-5426. Order these technical notes from the AFW Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019.

1WW-TN-78-1 (AD-A066839) *The Role Of Atmospheric Tidal Winds In The Production Of Ionospheric Sporadic-E*, by Capt. Bruce D. Springer, June 1978, 112pp. Summarizes an investigation of interactions among atmospheric tidal winds, the earth's magnetic field, and metallic ions in the upper atmosphere (90-180 km). Results support theory that upper atmospheric tidal winds play a critical role in formation of ionospheric sporadic-E. The contributions of various tidal wind modes are analyzed with extensive computer simulations. Available in Microfiche only.

1WW-TN-79-1 (AD-A067093) *The Use of 1WW Historical Terminal Forecast Performance Tables*, by Maj. Phillip D. Wood and CMSgt. John A. Ellington, March 1979, 16pp. Describes various elements of 1WW Historical Terminal Forecast Performance Tables. Numerous ways tables can be used, described, and illustrated.

1WW-TN-79-2 (AD-A069687) *A Methodology To Analyze Forecast Problems*, by Capt. James E. Pettet, April 1979, 13pp. Describes a problem analysis methodology recommended for use by base weather station managers whenever an adverse trend in forecast or local point warning performance is observed.

1WW/TN-80/001 (AD-A179133) *Prediction of Typhoon-Induced Peak Winds at Four Pacific Stations*, by Capt. James E. Pettet, September, 1980. Contains nomograms and instructions for estimating peak wind gusts at stations when typhoons are within 360 NM. Nomograms discussed in detail. Terrain influences also discussed.

1WW/TN-81/001 (AD-A118426) *Tropical Cyclone Intensity Estimation by Using the Dvorak Technique with Visual Satellite Imagery*, by Maj. Donald R. Cochran, December 1981, 16pp. See note. In 1975, V. Dvorak published a technique for estimating intensity of tropical cyclones by using satellite imagery. Measurement of certain cloud features indicate current wind speeds. A "model" development theory and picture clues contribute information on past and future trends. Dvorak's latest revisions discussed; current procedures for use with visual imagery given. NOTE: Procedures

described by this technical note have been effectively superseded by NOAA Technical Report NESDIS 11, Tropical Cyclone Intensity Analysis Using Satellite Data, by Vernon F. Dvorak, September 1984.

1WW/TN-81/002 (AD-A118428) *Positioning Tropical Cyclones in Satellite Imagery*, 1981, 31pp. Describes a three-step operational approach to positioning Pacific-based tropical cyclones in satellite imagery. In the pre-analysis stage the image is acquired, selectively processed, and correctly gridded. During the analysis stage, the circulation center of the cyclone is fixed based on cloud features in the image. In the third stage, post-analysis, quality control procedures ensure optimum accuracy of the determined position fix.

1WW/TN-81/003 (AD-A118427) *Sources of Errors in Locating Weather Systems in Imagery from Polar-Orbiting Satellites—A Short Primer in Spacecraft Geometry*, by Maj. David C. Danielson, 1981, 14pp. Accurate tracking of meteorological systems in satellite imagery requires recognition and correction of location errors. This note discusses three sources of location errors: satellite altitude, orbital anomalies, and satellite perspective. These errors may be corrected in the gridding process.

1WW/TN-83/001 (AD-B080673) *METSAT (Meteorological Satellite) User's Guide*, May 1983, 76pp. Describes the four operational meteorological satellite systems that provide METSAT data to Air Force units in the Pacific. Also describes Air Force DMSP direct readout site and mini-SIDS location operations, provides considerable background information on METSAT imagery characteristics. Discusses image accuracy, gridding, imagery types and forms, geographic coverage picture resolutions, data frequency and image identification techniques, and imagery analysis procedures. *Distribution limited to U.S. government agencies only.*

1WW/TN-83/002 (AD-A138792) *A Study of Western North Pacific Tropical Storms and Typhoons that Intensify After Recurvature*, by Maj. Charles P. Guard, November 1983, 28pp. Contrary to the findings of several past studies, many tropical cyclones intensify

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after recurvature, an unexplained behavior that has led to large forecasting errors. This study reveals two seasonal peaks of the behavior separated by a July minima in which intensification after recurvature (IAR) does not occur. A particular synoptic pattern is identified. Monthly characteristics of IAR are explained as functions of physical elements in the tropical cyclone's oceanic and atmospheric environment. Guidelines provided to help forecasters anticipate and react to IAR.

1WW/TN-84/001 (AD-B087539) *METSAT Imagery Interpretation Guide*, by Maj. Gordon R. Hammond, August 1984, 118pp. Provides descriptions and photographic examples of cloud and earth phenomena as seen from polar-orbiting and geostationary satellites (METSAT). Begins with look at basic cloud types, then

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covers comma cloud systems, low- and high-level wind flow cloud patterns. Ends with miscellaneous cloud/earth phenomena. Meant as a quick reference for METSAT imagery interpretation; can serve as part of unit's METSAT Imagery Reference File (MIRF).

1WW/TN-90/001 (AD-A234984) *An Overview of Tropical Circulation*, by Capt. Frank Sornatale, July 1990, 29pp. A discussion of tropical circulation and its role in supporting the larger general circulation system. Also discusses the historical presentation of general circulation theory, the influence of tropical circulation on heat and momentum budgets, and localized circulation patterns. However, tropical cyclones are omitted from the discussion.

3-5. 2WW TECHNICAL NOTES. The 2nd Weather Wing no longer exists; however, during its existence a number of technical notes were published. Questions about the following technical publications may be addressed to USAFE/DOW, Unit 3050, Box 15, APO AE 09094-5015. Order these technical notes from the AFW Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019.

2WW-TN-69-1 (AD-None) *Developing an Objective Forecast Study*, by Capt. Robert E. Black, June 1969, 14pp. Many of the articles written the past few years on objective forecast studies have covered various facets of studies—from how to select parameters to how to write them. This paper will comment on various aspects of objectives forecast studies but will try not to repeat that which is published elsewhere. It will discuss various phases of the study and give pointers and hints that may help you to avoid some of the more common pitfalls of conducting a forecast study.

2WW-TN-69-2 (AD-692731) *Cyclones and Anticyclones in Europe*, September 1969, 72pp. Numerous studies, dating from 1783, have been conducted on cyclone and anticyclone paths. This study discusses movement and generation of pressure centers (cyclones and anticyclones) from a theoretical and climatological point of view. It discusses, by month: pressure system paths over Europe, areas of genesis, and the relationship of paths to 500mb circulation. Cyclogenesis on lee side of a terrain barrier is discussed in light of the conservation of potential vorticity. Pettersen's development formula is used to show effect of land-locked bodies of water on genesis of pressure systems. Cyclone and anticyclone tracks vary from season to season, month to month. Tracks shown on charts discussed in light of these variations. Areas and factors affecting genesis also discussed.

2WW-TN-69-3 (formerly 2WWP 105-3)

2WW-TN-70-1 (AD-707497) *The Forecast Sounding Package*, June 1970, 27pp. The Forecast Sounding Package is an AFGWC-transmitted forecast field of temperature, humidity, and vertical velocity. It has numerous applications in forecasting: severe weather, icing, precipitation, and terminal forecasting of cloud and visibility categories. An appendix describes the AFGWC trajectory model.

2WW-TN-70-2 (AD-708141) *Forecasting Reduced Visibilities due To Atmospheric Aerosols*, June 1970, 7pp. The problem of forecasting low visibilities has become less a problem of forecasting restrictions due to condensed water droplets than to forecasting those due

to suspended particles. This paper discusses a formula and graph for calculating forecast visibility given initial conditions of visibility and relative humidity.

2WW-TN-70-3 (AD-712393) *Satellite Picture Interpretation for Europe*, September 1970, 56pp. Discusses various terrain and synoptic features of Europe, Africa, and the Middle East. Presents satellite pictures and a brief analysis of their content. Not available from 2 WW.

2 WW-TN-71-1 (AD-733429) *Understanding And Using FPS-77 Radar Data*, November 1971, 21pp. Discusses AN/FPS-77 weather radar, its scopes, controls, and procedures used at Hahn AB, Germany. RAMET code and scope photography discussed. Purpose is to inform using agencies of uses and limitations of information received from a radar station. Not available from 2 WW. *Recinded 880322.*

2WW-TN-72-1 (AD-None) *The Use of Conditional Climatology—Some Second Thoughts*, by Capt. Richard L. Walterscheid, April 1972, 9p. The introduction of conditional climatology (CC) tables broken out by ceiling and visibility separately has undermined the ability of these tables to provide the basis for a first guess TAF which supplies a better starting point than persistence. The rationale for using CC tables to provide a first guess TAF is grounded in the premise that one can select a verification category which is at least as likely as the persistence category. To select such a category we must be able to assign verification probabilities to each verification probabilities. A forecast scenario is suggested that takes this into account and exploits the real value of CC tables, namely, their ability to provide the basis for judgement.

2WW-TN-72-2 (AD-749493) *An Investigation of Thunderstorm Potential In Cold Air Cumulonimbi*, October 1972, 25pp. Introduces method for determining difference between cold air cumulonimbi with thunderstorm potential from those with no such potential for development. Problem frequently occurs in winter over northwestern Europe. Several theories on thunderstorm activity and observational evidence combine a simplified theory of cloud electrification. This

theory is applied in a stability index similar to the lifted index with the exception that parcels are raised to the -20°C level. The index is useful in cold air for separating areas of thunderstorms from those in which only cumulonimbus clouds occur.

2WW-TN-72-3 (AD-None) *The Accuracy of Conditional Climatology Tables*, October 1972.

2WW-TN-72-4 (AD-753683) *The Value of Our Forecasts*, November 1972, 25pp. Two simple cost-benefit models are presented. One evaluates cost effectiveness of forecast service in terms of the benefit derived by strict adherence to a strategy of acting solely on basis of forecasts in preference to acting solely on basis of existing weather. The other model evaluates marginal cost effectiveness of forecasts in terms of benefit derived by subscribing to AWS service in preference to a service based on persistence forecasts. Two relationships are derived that express savings per forecast and marginal savings per forecast in terms of measures of forecast performance. The study shows that the percentage increase in cost effectiveness and marginal cost effectiveness can be significantly greater than the percentage increase in performance. It also shows that a small increase in forecast performance can result in a significant increase in cost effectiveness.

2WW-TN-72-5 (formerly 2WW/P-105-13).

2WW-TN-72-6 (formerly 2WW/P-105-15).

2WW-TN-72-7 (AD-None) *An Objective Method for Forecasting Afternoon & Evening Thunderstorms*, July 1972. Afternoon and evening activity has caused considerable forecasting difficulties at Coleman AAF. An objective method was evolved which successfully forecasts this activity.

2WW-TN-73-1 (AD-None) *The European Climatological Slide Series*, June 1973, 15pp. A description is presented of the development of some 35mm climatological briefing slides for Europe. Advantages are given of using these seasonal slides which show maps overlaid with isopleths of various climatological parameters of importance to the military decision maker. Several recommendations are made to increase the effectiveness and optimize the value of the climatological briefing to the customer.

2WW-TN-73-2 (AD-None) *An Evaluation of Selected Stability and Moisture Parameters*, August 1973, 14pp. Stability and moisture parameters often used on composite weather charts are statistically evaluated using data recorded during a specific European airmass thunderstorm situation. The Showalter Stability Index shows the best performance as a thunderstorm indicator, but only with marginal superiority over the Total Totals Index. Dew point is shown to be a significantly better thunderstorm indicator than dew point depression. When used in combination with the Showalter Index, the other stability and combination of stability and moisture parameters shows poorer performance than "no skill" successive day data. To be most effective, a composite chart must include relevant data from independent sources.

2WW-TN-73-3 (AD-None) *Two Objective Methods of Using Trajectory Data*, September 1973, 19pp. Data from trajectory bulletins for an approximately four month period were correlated in several ways to determine predictors of thunderstorms and ceilings at Wiesbaden AB, Germany. Of the several parameters examined the 12-hour forecast of the total totals index was best correlated with thunderstorm occurrence. A "climatology" of Wiesbaden ceiling conditions at about 22Z was developed as a function of the degree of air saturation and amount of lifting that were inferred in the 00Z 24-hour trajectory data. Higher ceilings were well correlated with forecasts of dry, descending air, while lower ceilings were generally related to trajectories indicated to be rising and moist. Some useful correlations of ceilings with 36-hour trajectory forecasts were also found, though these were not as well related as were the 24-hour forecasts.

2WW-TN-74-1 (AD-None) *Use of Thickness in Forecasting Rain and Snow in Germany*, February 1974. Thickness values between 1,000 and 500 mb were compared with observed precipitation types. When thickness values were less than 528 geopotential decameters (gpdm), only snow occurred; with values greater than 535 gpdm, only rain was observed. Varying combination of precipitation forms occurred with thickness values between 528 and 534 gpdm. Forecasters at the European Tactical Forecast Unit routinely use thickness analyses and forecasts received via facsimile from the British Meteorological Office in preparation of Planning Guidance and Operational forecasts.

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2WW-TN-74-2 (AD-None) *The Application of Systematic Procedures to Visibility Forecasting in the Federal Republic of Germany*, June 1974. This note is concerned with the development and implementation of procedures relating standard real-time synoptic-scale parameters to the prediction of visibilities. Procedures used by the authors when preparing studies for selected bases in Germany are illustrated. Gradient-level winds, as determined from nearby mountain station observations, are shown to have a strong influence on the visibility at airfields in Germany. Refinements of these forecasts involve the application of low-level stability and moisture relationships.

2WW-TN-74-3 (AD-B000416L) *Weather Service Support to the 50th Tactical Fighter Wing, Hahn AB, Germany, 28 January 1974-22 February 1974*, October 1974. The impact of weather service on an F-4 tactical fighter wing's peacetime training activities was determined and evaluated. Major operational decision points where weather could have an impact were determined, improvements to weather services suggested.

2WW-TN-74-4 (formerly 2WW/P-105-19).

2WW-TN-74-5 (formerly 2WW/P-105-20).

2WW-TN-74-6 (formerly 2WW/P-105-21).

2WW-TN-75-1 (AD-None) *Forecasting the Occurrence of Thunderstorms Using Echo Tops and Equivalent Radar Reflectivity Factors (Z_e) as Measured on the AN/FPS-77 at Hahn AB*, September 1975, 6p. The development of a method to determine if thunderstorms are occurring from indicators observed by the FPS-77 weather radar was accomplished for Hahn Air Base, Germany.

2WW-TN-75-2 (formerly 2WW/P-105-22).

2WW-TN-75-3 (formerly 2WW/P-105-23).

2WW-TN-75-4 (formerly 2WW/P-105-27).

2WW-TN-76-1 (AD-None) *Trajectory Bulletin Uses for Forecasting the Occurrences of Precipitation and for Forecasting Passage of Weather Systems at Hahn AB, Germany*, March 1976, 12pp. The development of objective methods to use the trajectory bulletin forecast tool to improve local forecasting.

2WW-TN-77-1 (AD-A104219) *Report on the Results of the Probability of Lightning Condition Forecasting Test Conducted in 2WW During March, April, and May 1977*, July 1977, 31pp. Aircraft lightning strikes are a significant and previously unforecasted hazard to aircrews in Europe. A logic-diagram technique was developed to forecast probability of occurrence of all known weather conditions that relate to such strikes. Logic was developed by meteorological reasoning and modified on the basis of questionnaire feedback from aircrews. Though results contained some pessimistic bias, indications from more than 100 responses showed that a significant number of crews wanted the service, and that increasing probability values in the issued forecasts were associated with increasing likelihood of crews encountering lightning.

2WW-TN-78-1 (AD-None) *Results of a Set of Subjective, Probability Forecasts Prepared From Very Limited Weather Data*, February 1978, 13pp. In April 1977, the Aerospace Sciences Division of 2WW began a program of technique development in terminal forecasting from limited data. The major problem under investigation has been to find ways to forecast when communications are cut off and available weather data are nearly nil; i.e., limited to maps on hand and a current observation.

2WW-TN-78-2 (AD-None) *2-3 November 1977 Wind Storm (A Review and Some Thoughts)*, January 1978, 18 pp. A wind storm of moderate intensity moved through Western Europe on 2-3 November 1977. The sequence of events (surface and upper air); a summary of how well 2WW units reacted to these events; and a post analysis are provided. Readers are encouraged to review the 22 charts and information provided and provide their own post analysis.

2WW-TN-78-3 (AD-None) *The Parameter Utilization Program (PUP)*, April 1978, 64pp. This report describes a systematic method of three dimensional weather analysis and forecasting. The significance of changes in atmospheric parameters; such as moisture, temperature, wind shear, diffluence, confluence, etc.; are illustrated by case studies.

2WW-TN-78-4 (AD-None) *Some Further Results of Subject Probability Forecast Prepared from Very Limited Data During a Winter Period*, April 1978, 12pp. This report is another interim report on the results of technique development in terminal forecasting from limited data. The

results from the first 125 of these forecasts were reported in 2WW Technical Note 78-1, to which this article will frequently refer. Currently we are describing the results of a set of 58 new forecasts, prepared during Winter Season weather, from 9 January 1978 to 31 March 1978.

2WW-TN-78-5 (AD-None) *Selected Case Studies and Synoptic Patterns Bringing Significant Weather to Europe*, July 1978, 130pp. A series of case studies and examples of significant European weather events is provided. Surface winds, thunderstorms, rain and snow are treated separately.

2WW-TN-78-6 (AD-None) *Still Further Results of Subjective, Probability Forecasts Prepared from Very Limited Weather Data During a Fair Weather Period*, November 1978, 10pp. The results of a third sequential set of consensus and individual forecasts made under conditions of weather-data denial are given for a fair-weather period. Forecasts, made in probability form for 3-hour and 24-hour ceiling/visibility, are scored by the Brier Score and compared to a standard which takes into account weather variability within the 6-month sample.

2WW-TN-78-7 (AD-None) *European Paradox Data for Europe, the Mediterranean, the Middle East and North Africa*, November 1978. Note: Available in microfiche only.

2WW-TN-79-1 (AD-None) *Report on the 2WW Test of the Concept of Appending Ceiling and Visibility Probabilities to the Terminal Forecast*, January 1978, 55pp. Not available from 2WW. Second Weather Wind conducted a test of making probability forecasts for ceiling and visibility category at three of its forecast units. Results are presented showing that forecasters could demonstrate skill early in the test and continued to do so throughout the test. Best results were obtained for short range forecasts. Verification efforts, as opposed to training and forecasting, comprised the bulk of the extra workload.

2WW-TN-79-2 (AD-None) *On the Occurrence of Unusual Weather in Parts of Western and Central Europe from 19-25 May 1978*, February 1979, 27pp. A seven-day period of unseasonably poor weather during May 1978 is examined. The synoptic, dynamic, and climatological aspects of this occurrence are discussed. Forecasting difficulties are considered with suggestions being offered for future similar occurrences.

2WW-TN-79-3 (AD-None) *Daily Climatology, A Look at the Ramstein Year*, March 1979, 83pp. Ramstein AB observations for 6-7 years are examined to determine if there are unique sub-month scale periods of unique weather which would be hidden in the monthly summaries of the RUSSWO. European weather singularities are also discussed and are compared to the running three- and five- day means of the Ramstein daily climatology. The periods and trends discovered agree nicely with the European weather singularities and with one's subjective concept of the Ramstein year. The separate periods identified are not, however, significantly different in the statistical sense. Typical values of selected meteorological elements are also provided.

2WW-TN-79-4 (AD-None) *A Catalogue of some Forecaster Hints Applicable to European Forecasting*, March 1979, 8pp. A catalogue of some hints pertinent to weather forecasting in Europe is presented. Incorporated in 2WW/FM-83/003.

2WW-TN-79-005 (AD-None) *Probability of Lightning Conditions—Updated*, March 1979, 4pp. The goals and limitations of the probability of lightning condition (POLC) program are discussed. Introductory background material is presented for the forecaster preparing to make POLC forecasts. Not available from 2WW.

2WW-TN-79-006 (AD-None) *Final Report on Subject, Probability Forecasts Prepared from Very Limited Weather Data*, April 1979, 13pp. This report is the fourth and last of a series covering technique development in forecasting with very limited weather data. The forecasts were made each working day between October 1978 and March 1979, in probability form, prepared subjectively by individuals and by consensus. The forecast elements were ceiling and visibility category, verified at the 3-hour and 24-hour points, using the Brier Score compared to a standard score which takes weather variability into account.

2WW-TN-79-007 (AD-A131873) *Probability Forecast Verification Aids*, April 1979, 10pp. Explains purpose and use of two worksheets designed for collection and analysis of probability forecast data. Provides instructions for use of HP-97 computer software for computing Brier Score and related statistics. Note: Document is partially illegible.

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2WW-TN-79-008 (AD-None) *A New Technique for Forecasting the Occurrence of Fog and Low Stratus Ceilings by Use of Chart*, September 1975, 35pp. A new technique for forecasting fog and low stratus ceilings in Europe is presented. This method consists of a flow chart or fog logic diagram leading through various meteorological parameters from which the most essential turned out to be the 850-mb wind speed and the temperature-dewpoint spread at the surface. Its principle item is a stability index for the layer between the surface and the 850-mb level. The stability index alone and the entire flow chart were tested against dependent and independent data, the latter leading to the expectation that a fog forecast can be improved by using this method. The main drawback of this method is that it requires forecasted parameters as data input and that it probably suppresses local effects too much. The advantage is its objective nature and its centralized use.

2WW/TN-80/001 (AD-None) *A Guide For Forecast Detachment Operating Instructions(DOIs) and Standing Operating Procedures(SOPs)*, 1 August 1980, 98pp. The purpose of this technical note (TN) is to crossfeed some of the better forecast related DOIs and SOPs in the wing. Also included, for your consideration, are some example TAF worksheets and an excellent stateside unit LAFP that the MAC/IG rated as laudatory. Our thanks to the units who made contributions to this TN.

2WW/TN-83/001 (AD-B0761591) *A Guide For Meteorological Briefing For VFR And Low-Level Flying In Critical Weather Conditions (Hinweise Fuer Die Wetterberatung Von Sicht-Und Tiefflugen Bei Kritischen Wetterlagen)*, 15 February 1983, 24pp. Examines how reports of adverse weather conditions correlate to topography and pilot reports in Germany. Demonstrates that specified routes or areas are accessible to low-level flight when heights of cloud bases at selected reference stations reach specified values. Certain routes and/or meteorological conditions impose special problems and are discussed. Text keyed to three color maps that show restricting terrain features. *Distribution authorized to U.S government agencies only; proprietary information, 15 February 1983. Other requests shall be referred to USAFE/DOW, APO New York 09012-5000.*

2WW/TN-83/002 (AD-None) *Point Forecasts of Meteorological Parameters*, translated by Maj. John E. Rubenacker, 1 May 1983, 9pp. An explanation of the

information contained in the GMGO product "Point Forecasts of Meteorological Parameters".

2WW/TN-85/001 (AD-A160166) *The European LFM-Style Forecast Aids*, by Maj. Harry D. White, III, 1st Lt. Michael Adams, and SMSgt. Danny G. McGrew, 8 May 1985, 27pp. Discusses FXEU-series facsimile charts, reviews basic meteorology, and describes some chart features.

2WW/TN-86/001 (AD-A202802) *Forecasting Freezing Precipitation in Central Europe*, by Herr Harald Strauss, Capt. David W. Rust, SMSgt. Danny G. McGrew, and Sgt. F.G. Tower, November 1986, 136pp. Documents results of freezing precipitation workshop held October 25, 1985 at the 31st Weather Squadron. A common worksheet was developed for all 2WW Central European forecasters. Contains climatology, case studies, and conclusions.

2WW/TN-86/002 (AD-A176756) *An Objective Rain/Snow Determination Technique for the Federal Republic of Germany*, by Herr Harald Strauss and Sgt. Francis G. Tower, December 1986, 19pp. Describes an objective technique for determining the probability of precipitation's being liquid or solid. Seven predictors used to determine probability. Includes a method for determining those predictors as functions of station elevation.

2WW/TN-86/003 (AD-A176732) *Heavy Snowfall Situations in Central Europe*, by Herr Harald Strauss and SMSgt. Danny G. McGrew, December 1986, 92pp. Describes nine typical heavy snowfall situations that have occurred in Central Europe. Appendix A gives Baur types.

2WW/TN-87/001 (AD-None) *Technical Library Guide: Protecting Unclassified Technical Documents*, by MSgt. Thomas D. Avery, March 1987, 21pp. A guide and reference for Air Weather Service personnel who create, receive and/or release unclassified limited distribution documents. Discusses DoD background on limited distribution of unclassified technical documents and the limited distribution marking system. Also provides guidance on release of AWS unclassified technical documents to foreign nations/nationals.

2WW/TN-87/002 (AD-B116607) *Second Weather Wing's Europe Map Type Catalog, Volume 1, Westerly Flow Over Central Europe*, by Herr Harald Strauss,

July 1987, 196pp. Errata, September 1987 (page changes). The first in a series of European weather map type catalogs, designed and published by Second Weather Wing Aerospace Sciences. Based on the work of F. Baur in the 1940s, this effort expands European map typing and brings the focus of Baur's original use as a long-range forecast tool to the near-time scale. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-88/001 (AD-B119840) *Second Weather Wing's Europe Map Type Catalog, Volume II, Southwesterly Flow Over Central Europe*, by Herr Harald Strauss, January 1988, 105pp. The second in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecasting tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-88/002 (AD-A191881) *Maximum and Minimum Temperature Forecasting in Europe*, by Lt. Col. Donald L. Best, January 1988, 22pp. A guide to forecasting maximum and minimum temperatures in Europe. Gives traditional approaches, with strengths and weaknesses. Provides a way to tailor reader's own 850-mb climatological temperatures to produce forecasts. Example.

2WW/TN-88/003 Not used.

2WW/TN-88/004 (AD-B124026) *Second Weather Wing's Europe Map Type Catalog, Volume III, Low Over Scandinavia*, by Herr Harald Strauss, April 1988, 88pp. The third in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-

time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-88/005 (AD-B124416) *Second Weather Wing's Europe Map Type Catalog, Volume IV, High Close to the British Isles*, by Herr Harald Strauss, April 1988, 111pp. The fourth in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-88/006 (AD-B128947) *Second Weather Wing's Europe Map Type Catalog, Volume V, High Over Central Europe*, by Herr Harald Strauss, July 1988, 93pp. The fifth in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-88/007 (AD-B129647) *Second Weather Wing's Europe Map Type Catalog, Vol VI, High Over Scandinavia Extending into Central Europe*, by Herr Harald Strauss, November 1988, 92pp. The sixth in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range Forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications

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outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-89/001 (AD-B133248) *Second Weather Wing's Europe Map Type Catalog, Vol VII, Low Pressure over Central Europe*, by Herr Harald Strauss, March 1989, 193pp. The seventh in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-89/002 (AD-B143994) *Second Weather Wing's Europe Map Type Catalog, Volume VIII, Southerly Flow over Central Europe*, by Herr Harald Strauss, May 1989, 87pp. The eighth in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (e.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-89/003 (AD-A222290) *The Numerical Forecast Model BKF(G): Characteristics and Experiences*, by Dr. Helmut Walter, German Military Geophysical Office (B II), July 1989, 19pp. The BKFG model used by the German Military Geophysical Office (GMGO) is available to the European Forecast Unit (EFU) for retransmission on the AFDIGS circuit. The tech note explains the model and the transmitted output available to AFDIGS users. *Distribution authorized to U.S. government agencies only, administrative or operational use, 1 March 1987. Other requests for this document shall be referred to USAFE/DOW.*

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2WW/TN-89/004 (AD-B144515) *Second Weather Wing's Europe Map Type Catalog, Vol IX, Southeasterly Flow over Central Europe*, by Herr Harald Strauss, September 1989, 89pp. The ninth in a series of documents depicting a subset of weather types over Europe. Based on the work of F. Baur in the 1940s, this effort significantly expands European map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time. These catalogs are designed to help weather forecasters who, under conditions of severe data denial (c.g., during extended communications outages), are provided possible synoptic situation maps with associated weather discussions. Charts in this document are selected excerpts from the European Meteorological Bulletin produced by Deutsches Wetterdienst.

2WW/TN-89/005 (AD-B144491) *European Forecast Unit Backup to Air Force Global Weather Central*, by Capt. William G. Munley, Jr., 2nd Lt. Gerald R. Rugg, and MSgt. Melvin W. Bradley, November 1989, 12pp. Explains European Forecast Unit (EFU) backup products for Category II (long-term) AFGWC outages. Examples of current AFGWC products and EFU backup products are provided for comparison. Although the EFU products differ in appearance, they contain the same information as their AFGWC counterparts.

2WW/TN-90/001 (AD-B149907) *The Boundary Layer Model (BLM): A Users Guide*, compiled by Capt. William G. Munley, Jr., with translations by 1st Lt. Peter A. Engelmann, May 1990, 43pp. The BLM used by the German Military Geophysical Office (GMGO) is made available to the European Forecast Unit (EFU) for retransmission on the EURDIGS circuit. This tech note explains the model and the transmitted output available to EURDIGS subscribers.

2WW/TN-90/002 (AD-B152837) *2nd Weather Wing's Europe Map Type Catalog, Volume X, How to Use the 2 WW European Map-Types Series*, by Herr Harald Strauss, December 1990, 86pp. Tenth, and final, in a series of volumes depicting a subset of weather types over Europe. Based on work of F. Baur in the 1930s and 1940s, this effort significantly expands Europe map typing and brings focus from Baur's original use as a long-range forecast tool to the near-time scale.

3-6. 3WW TECHNICAL NOTES. The 3rd Weather Wing no longer exists, however, during its existence a number of technical documents were published. Order these technical notes from the AFW Technical Library (AFWTL), 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019. (SSTN = Scientific Services Technical Note.)

3WW SSTN 1 (AD-None) *Relation Between Geographical Coordinates and GWC Grid Coordinates*, February 1962, 6pp.

3WW SSTN 2 (AD-None) *Third Weather Wing Four-Level Model*, February 1962, 16pp.

3WW SSTN 3 (AD-None) *The Forecasting of Clouds and Airframe Icing*, by Lt. Col. Clayton E. Jensen, May 1962, 25pp. Adiabatic vertical velocities are computed for atmospheric layers and used to modify dewpoint-depression fields in twelve-hourly steps. Assuming a certain correspondence between dewpoint-depression and amount of cloudiness, cloud forecasts can be made for specific atmospheric layers; for example, 850-700, 700-500, 500-300, and 300-200 millibars. For the lower two layers, airframe icing forecasts are produced on the basis of predicted conditions of cloudiness, temperature, and lapse rate.

3WW SSTN 4 (AD-None) *A Review of Jet Stream and Mountain Wave CAT with Suggested Evasive In-Flight Tactics*, March 1963, 8pp.

3WW SSTN 5 (AD-None) *Weather Radar*, by Lt. Col. Herschel H. Slater and Maj. Robert E. Dean, July 1963. Reprinted September 1963, 25pp.

3WW SSTN 6 (AD-None) *Clear Air Turbulence*, by Capt. Norman N. Richardson, September 1963, 29pp.

3WW SSTN 7 (AD-None) *The Use of Diurnal Temperature and Dew-Point Curves*, by Stanley J. Kimball, Capt. Norman N. Richardson, and Dean H. Frey, March 1964, 7pp. See 5WW TN 72-1, a more current version.

3WW SSTN 8 (AD-None) *On Computation of Pitch, Roll, Yaw, and Geographical Coordinates of Any Point on a Meteorological Satellite Photograph*, by Maj. Edwin E. Brown, March 1964, 13pp. Pitch, roll, and yaw of a meteorological satellite, such as TIROS, is computed from the geographical coordinates of two points that are identified on a satellite photograph, the location of the satellite subpoint at the time the

photograph was taken, the height of the satellite, and the inclination angle of the equatorial and orbital planes. An initial three dimensional coordinate system with the origin at the satellite and the z axis coincident with the camera's optical axis is rotated through five angles so that the resultant z axis passes through the subpoint. Deviations of the initial x and y axes (photographic plane) from the resultant, horizontal xy plane are termed roll and pitch respectively. The angle between the y axis and the subpoint track is termed yaw. A technique to compute the geographical coordinates of any point on the photograph is described. Matrix algebra is employed to perform the rotations. Rotation angles are computed from plane and spherical trigonometric relationships.

3WW SSTN 9 (AD-None) *Systematic Use of Empirical Data to Improve 3WW Cloud Forecasting Model*, by Maj. Herbert Edson, May 1964, 20pp.

3WW SSTN 10 (AD-None) *Low-Level Turbulence & Mapping, with a Computer Nomogram*, by Maj. Edwin E. Brown, May 1964, 11pp.

3WW SSTN 11 (AD-None) *Corrective Clear Air Turbulence*, by Capt. Thomas E. Stanton, May 1965, 33pp.

3WW SSTN 12 (AD-None) *Mountain Potential*, by Maj. George K. Pickell and Capt. Thomas E. Stanton, May 1965, 19pp.

3WW SSTN 13 (AD-None) *Numerical Cloud and Icing Forecasts*, by Maj. Herbert Edson, September 1965, 61pp. The 3rd Weather Wing (Air Weather Service) automated Cloud and Icing Forecast Program produces hemispheric moisture and temperature forecasts at four levels of the atmosphere (850-, 700-, 500-, and 300-mb), which are converted to layered cloud and icing forecasts as well as total cloud forecasts. The program employs synoptic cloud data to modify and initialize moisture analysis. These moisture values are then advected with three-dimensional trajectories using two-hourly forecasts of horizontal and vertical winds. A forecast moisture field is thus established and converted to cloud amount through use of a

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Condensation Pressure Spread (CPS) to Cloud Correspondence Table and certain discriminating vertical motion and temperature considerations. The trajectory advection technique requires an input from a six-level height model which produces stream functions at fixed levels and vertical velocities within layers at 2-hour time intervals. Forecast horizontal winds are computed directly from stream functions while vertical motions at the levels are taken from a vertical profile which is fitted to the layer values. Low, middle, high, and total cloud forecast are obtained from the model on a global basis out to 48 hours. These forecasts have been used as an operational tool at the Global Weather Central (GWC) for over a year.

3WW SSTN 14 (AD-None)] *The 3D Weather Wing Six-Level Model*, by Maj. Hugh M. O'Neil, November 1965, 35pp.

3WW TN 15 (AD-None) *Meteorological Scaling Theory, Energetic Consistency Constraints, and Their Application to Numerical Models under Development at Hq Third Weather Wing*, by Maj. Harold B. Hart, March 1967, 58pp.

3WW TN 16 (AD-None) *Verification of Automated Temperature*, by Lt. Col. Herbert Edson, Maj. Hugh M. O'Neil, and Capt. Charles P. Stephens, April 1967, 57pp. Divided into two sections: The first, by Lt. Col. Edson and Capt. Stephens, discusses performance of cloud, temperature, and moisture forecasts produced by the CPS-Trajectory Model. The second by Maj. O'Neil, describes verification techniques used to evaluate the six-level height and wind forecast model. The verification programs that provided information about the performance of the six-level model were by Maj. George G. Main.

3WW TN 17 (AD-None) *Some Considerations in Choosing an Optimum Forecast Method for Various Length and Time Scales of Cloudiness*, by Maj. Robert A. Derrickson, Jr., April 1967, 19pp.

3WW TN 18 (AD-None) *Tracking Weather Echoes Using Quantitative FPS-77(V) Procedures*, by Maj. Hugh E. Hanna, Jr., September 1968, 14pp. This paper illustrates use of ISO ECHO procedures for making quantitative measurements of convective weather intensity. Discusses major differences between FPS-77 and CPS-9.

3WW TN 19 (AD-None) *Statistical Aids to Terminal Forecasting*, by Maj. Hugh E. Hanna, Jr. and Maj. Frank G. Johnson, September 1968, 20pp. Describes existing and programmed computerized aids to terminal weather forecasting. Discusses application of conditional climatology with respect to the forecast. Several special application tables are provided: wind stratified persistence probability, onset duration, diurnal heating curves, and others. Thumb rules for application of statistical data of format described to the terminal problems in 3WW are presented. Differences between various forms of conditional probability are discussed.

3WW TN 21 (AD-None) *A Technique for Applying Trajectory Forecasts from the Trajectory Computer Program to Offutt AFB, (24 October 1968 - 30 November 1968)*, by Maj. Hugh E. Hanna, Jr., December 1968, 14pp. Test application of computerized trajectory forecasts to the Offutt terminal aerodrome forecast began on 24 October 1948. After several days of testing on a real-time basis, it became apparent that AWSTR 210, "The Use of Trajectories in Terminal Forecasting," August 1968, was not explicit enough for literal application to the base TAF. A program was then created to correlate forecast elements with observed weather for different wind directions to evaluate local influences, primarily down-slope, on the utility of trajectory information. This was required due to the apparent tendency of the trajectory program to amplify subsidence and associated drying. Application of revised criteria for Offutt resulted in a 4 percent overall improvement in the percent correct hour-forecasts prepared. The increase was considered significant since trajectory data were helpful in identifying many deteriorating trends.

3WW-TN-69-1 (AD-681146) *An Investigation of Spring Fog and Stratus at Wurtsmith AFB, Michigan*, by Maj. Frank G. Johnson, January 1969, 34pp. Correlates wind, temperature, and dew point with various categories of fog or stratus occurring during morning or midday.

3WW-TN-69-2 (AD-None) *An Investigation of Winter Fog and Stratus at McCoy AFB, Florida*, by Maj. Frank G. Johnson, February 1965, 31pp. This report correlates wind, temperature, and dew point at 1700L with various categories of fog or stratus occurring during the morning hours at McCoy AFB, Fla.

3WW-TN-69-3 (AD-(190112) *Snowshower Activity in the Upper Great Lakes*, by Maj. Frank G. Johnson, June

1969, 89pp. Correlates temperature, dew point, dew-point depression, sea-level pressure, and time of day with snowshower activity in upper Great Lakes area. Includes composite 850 and 1,000 mb charted 6 to 18 hours before shower activity starts.

3WW-TN-69-4 (AD-690174) *An Experiment in Utilization of Relative Probabilities of Weather Conditions When Deteriorations Occur*, by Maj. Hugh E. Hanna, Jr. and David L. Nelson, July 1969, 20pp. Conditional climatology tables for 3-hour initial time blocks rerun from hourly surface data tapes from 3WW library. Initial program modified to exclude considerations of all 24-hour succeeding time-periods unless at least one observation in that 24-hour period deteriorated to lower category. Effects of the ever-present diurnal cycle and relative timing which may be deduced are studied in detail.

3WW-TN-69-5 (AD-None) *Forecasting Minimum Cloudiness at DaNang RVN, Hanoi NVN, and Vinh NVN, during the Early SW Monsoon Season Using Upper-Level Northern Hemisphere Composite Maps*, by Maj. Hugh E. Hanna, Jr., September 1969, 38pp. Composite antecedent upper-level charts for 1000, 700, and 300 mb are given for selected stations in Southeast Asia. Composite charts precede minimum total cloudiness. Features that deviate from monthly mean charts are explained and possible operational uses are suggested.

3WW-TN-70-1 (AD-698835) *Synoptic Features Associated with Snow at Offutt AFB, Nebraska*, by Maj. Frank G. Johnson, January 1970, 14pp. Correlates wind direction to onset of snow at Offutt AFB, Neb. Average 850-mb charts 0 to 11 hours before snow occurrence are included.

3WW-TN-70-2 (AD-None) *Terminal Forecast Verification*, by Lt. Col. Ray T. Telfer and Capt. Randall C. Webb, February 1970, 37pp. This paper presents philosophical and operational concepts of the 3WW TAF verification system. Discusses concept of measuring forecasting performance relative to previous performance, as well as use of automated forecast verification diagnostic material as a management tool.

3WW-TN-70-3 (AD-738302) *An Investigation of February Fog at March AFB, CA*, by Maj. Frank G. Johnson, June 1970, 47pp. Correlates certain antecedent,

start, minimum, and breakup conditions associated with February fog at March AFB, Calif.

3WW-TN-71-1 (AD-None) *Performance Characteristics of NMC's Operational Numerical Models*, by Harry Brown, November 1970, 34pp. A reprint of a seminar presented by Harry Brown of the National Meteorological Center, NWS, during a February 1971 forecaster training course. Performance of the NMC barotropic-mesh, 3-level, and 6-level models is discussed. Differences between predicted and observed charts are discussed.

3WW-TN-71-2 (AD-729868) *An Objective Technique for Forecasting Wintertime Radiation Fog at Fairchild AFB, WA*, by Dwayne N. Burgess and Darrell T. Holland, September 1971, 12pp. Presents an objective technique for forecasting wintertime radiation fog at Fairchild AFB, Wash. Using data available by 1500L, a technique is presented to forecast occurrence of non-occurrence of radiation fog restricting visibility to less than 2 miles between 0000L and 0800L for November through February. Eight predictors examined: five combinations showed promise; three were used in this study. Predictor combinations used are: surface wind speed vs temperature-dew-point temperature; temperature vs temperature—dew-point temperature; and surface wind speed vs dew-point temperature. POR used: 1952-1962. Independent sample used: 1965-1966.

3WW-TN-71-3 (AD-735724) *Thermal Parameters as a Predictor of Precipitation Type for Loring AFB, Maine*, by Limon E. Fortner, Jr. and Dale G. Rogers, September 1971, 21pp. Presents a summary of thermal variables as precipitation type predictors at Loring AFB, Maine. Material may be used to make an objective forecast when input data is extracted from current observations and prognostic facsimile charts. The Caribou, ME, radiosonde data (0000UTC and 1200UTC) is correlated against precipitation type that occurred at Loring AFB, Maine. Thermal variable combinations used were: 1,000-850 mb thickness; 1,000-700 mb thickness; 1,000-500 mb thickness; surface, 950 mb, 850 mb, and 700 mb temperatures.

3WW-TN-71-4 (AD-733583) *Description and Use of 3rd Weather Wing Onset-Duration Tables*, by Maj. David L. Bailey, October 1971, 16pp. This note describes computation and display of hourly onset-duration tables based on long periods of sequential hourly weather

observations. Initial data is stratified by weather element, category, and hour of initial occurrence. Typical elements are ceiling or visibility. Categories consist of discrete increments of ceiling height or visibility. The tables for each hour contain the number of times a particular element and category began (onset), the category at the previous hour, how many hours this condition persisted (up to 6 hours), and the category subsequent to the occurrence. An example of the intended use of the tables is presented.

3WW-TN-71-5 (AD-733036) *An Experiment in Additional Stratification of Conditional Climatology Summaries for Short-Term Forecast Aids*, by Dale G. Rogers, November 1971, 13pp. Describes results of an experiment to use two additional elements in stratifying observational data for conditional climatology (CC) summaries. Conventional CC aids used throughout AWS stratify hourly observations by month, hour, initial ceiling/visibility category, and final ceiling/visibility category at some later time. Later versions add surface wind direction sectors as a fifth variable. This note introduces use of present weather and ceiling/visibility trend over previous hour as the sixth and seventh variables in determining the conditional probabilities of five ceiling/visibility categories 4 hours from initial observation. A sample of the output is presented.

3WW-TN-72-1 (AD-754927) *Thermal Parameters as A Predictor of Precipitation Type for Kincheloe AFB, Michigan*, by Limon E. Fortner, Jr. and Dale G. Rogers, February 1972. Revised February 1973, 22pp. This paper presents a summary of thermal variables as predictors of precipitation type at Kincheloe AFB, Mich. The material presented here may be used in the preparation of an objective forecast when input data is extracted from current observations and prognostic facsimile charts. The Sault Ste. Marie, Mich., radiosonde data (00UTC and 12UTC) are correlated against precipitation type that occurred at Sault Ste. Marie AFB, Mich. Thermal variable combinations used here were 1,000-850 mb thickness, 1,000-700 mb thickness, 1,000-500 mb thickness, 850-700 mb thickness; surface, 950 mb, 850 mb, and 700 mb temperatures; 850 mb wind direction.

3WW-TN-72-2 (AD-753418) *Thermal Parameters As A Predictor Of Precipitation Type For Ellsworth AFB, South Dakota*, by Dale G. Rogers, Limon E. Fortner, Jr., William L. Kneas, and Michael P. Ciancolo, April 1972, 19pp. Gives summary of thermal variables as precipitation type predictors at Ellsworth AFB, S.D.

Material may be used in preparation of objective forecast when input data extracted from current observations and prognostic facsimile charts. Rapid City, S.D., radiosonde data (0000UTC and 1200UTC) correlated against precipitation type that occurred at Ellsworth AFB, S.D. Thermal element combinations used: 1,000-850 mb thickness; 850-700 mb thickness; 1,000-500 mb thickness; surface, 850 mb and 700 mb temperatures; 850 mb wind direction.

3WW-TN-73-1 (AD-756881) *Synoptic Features Associated with Moderate and Heavy Snow for Loring AFB, Maine*, by Limon E. Fortner, Jr., and Paul Mulder, February 1973, 15pp. The table of event frequency for moderate and heavy snow and the charts presented in the note were prepared from data extracted from the Loring AFB, Maine, hourly surface observations tape and the historical map tapes. Average map displays (AVMAPS) were prepared for 1,000 mb, 850 mb, 700 mb and 500 mb for moderate to heavy snow cases associated with an initial surface wind from the northeast quadrant or the southeast quadrant. Note: A February 1989 3WW/DNS review of this TN shows that it has little value in forecasting snow at Loring AFB, Maine. It could, however, be of value at other locations.

3WW-TN-73-2 (AD-762289) *Thermal Parameters as a Predictor of Precipitation Type for Carswell AFB, Texas*, by Limon E. Fortner, Jr., and Billie E. Grubbs, April 1973, 15pp. A summary of thermal variables as precipitation type predictors at Carswell AFB, Texas. Material may be used to make an objective forecast when the input data are extracted from current observations and prognostic facsimile charts. The Greater Southwest Airport (GSW), Fort Worth, Texas, radiosonde data (for 0000UTC and 1200UTC) are correlated against precipitation type that occurred at Carswell AFB, Texas, within 3 hours of radiosonde time. Thermal combinations used were: 1,000-850 mb thickness; 1,000-700 mb thickness; 1,000-500 mb thickness; surface and 850 mb temps.

3WW-TN-73-3 (AD-None) *Use of Forecasting Statistical Aids*, by Capt. Russell W. Reed, September 1973, 13pp. Discusses the nature, advantages, and limitations of statistical aids. Also discusses how the aids should be maintained and how they should be used in the forecasting routine. Several statistical aids provided by 3WW/DN are explained. This note is in outline form to increase its utility as a reference.

3WW-TN-73-4 (AD-None) *Thermal Parameters as Predictors of Precipitation Type for Grand Forks AFB, North Dakota*, by Capt. Russell W. Reed, October 1973, 17pp. Eight individual thermal parameters and five sets of two parameters from Bismarck, ND., radiosonde data tapes are correlated with the type of precipitation that occurred at Grand Forks AFB, ND., within three hours of radiosonde time. Thermal parameters tested are 1,000-850 mb, 1,000-700 mb, 1,000-500 mb, and 850-700 mb thickness, and surface, 950 mb, 850 mb, and 700 mb temperature. The period of record is May 1959 to August 1964.

3WW-TN-73-5 (AD-770037) *Selected Thermal Parameters as Predictors of Precipitation Type for Offutt AFB, Nebraska*, November 1973, 13pp. Four individual thermal elements (and three combinations of two) from Omaha radiosonde data tapes are correlated with the type of precipitation occurring at Offutt AFB, Neb., within 3 hours of radiosonde time. Elements tested were 700 mb temperature, 850 mb temperature, surface temperature, and 1,000-500 mb thickness. Main criterion for selection was availability of forecast values.

3WW-TN-74-1 (AD-None) *Index of Technical Notes Prepared by 3d Weather Wing, Aerospace Sciences Division*, by Capt. Russell W. Reed, March 1974, 10pp. Lists 3WW technical notes issued between February 1962 and November 1973.

3WW-TN-75-1 (AD-None) *Use of National Weather Service (NWS) Prognostic Products*, by Capt. Russell W. Reed, September 1975, 18pp. Uses of National Weather Service (NWS) numerical model output, model output statistics (MOS) products, quantitative precipitation forecast (QPF), and heavy snow forecast progs are discussed. Gives steps for using these products and tips for their use. Includes discussions of FOUS Detailed PE Guidance Bulletin and on development forecast studies using model output.

3WW-TN-75-2 (AD-688845) *Lyle Stratus Study for Forecasting Gulf Stratus at Randolph AFB, Texas*, January 1969, 20pp. Gulf Stratus in Texas is defined as a stratus cloud layer formed by nocturnally cooled Gulf air flow. Warm moist air from the Texas Gulf coastal area is cooled to saturation by nocturnal radiation and adiabatic cooling as it moves upslope from the coast to the 500- to 900-foot elevations of central Texas. Forecasting methods have concentrated on forecasting low-level moisture and wind flow. Pressure gradient

(rather than wind flow) was used for this study because pressures were thought to be more representative and timely than wind. The 00UTC pressure data gave 89 percent accuracy for occurrence and nonoccurrence of a stratus ceiling at Randolph AFB, Texas. Formation of stratus ceilings occurred within 1 hour and 15 minutes in 63 percent of cases and formed within 300 feet of forecast height in 62 percent of cases. Minimum ceilings within 300 feet of forecast occurred in about 65 percent of cases.

3WW-TN-75-3 (AD-None) *Wind Forecasting—Colorado Springs Area*, by Kenneth E. German and Robert C. Miller, December 1975, 25pp. Several rules for forecasting in the Colorado Springs area are reviewed and summarized. The importance of low-level stability is stressed. Two major divisions are made: stable and unstable cases. Stable cases generally involve winds associated with outbreaks or surges of arctic or cold continental air, and are isolated from the winds aloft by the strong frontal inversion. The unstable cases generally involve determining when a mountain wave will appear. The main mechanism is mid-level cooling, but there are others.

3WW-TN-76-1 (AD-A029003) *Low-Level Moisture Advection*, by CMSgt. Eugene M. Weber, August 1976, 28pp. Several years of data were reviewed to update and expand on 8th Weather Squadron Technical Note 10-7. This TN was developed by the author for Whiteman AFB, Mo., in 1965. Two main low-level moisture patterns in the central U.S. (residual moisture and gulf moisture) are identified. Advection and contributions of these patterns are discussed. Relationship between the low-level jet and gulf stratus advection is detailed with three distinct tracks/types of moist tongues designated. Includes forecasting techniques for identifying and determining the extent and rate of movement of gulf moisture/stratus.

3WW-TN-76-2 (AD-None) *Major Snowstorm Development Over the Midwest United States*, by CMSgt. Eugene M. Weber, December 1976, 94pp. This technical note discusses the atmospheric conditions essential to the development of major wintertime storm systems over the midwest (Central United States). Primary emphasis is placed on determination of areas favorable for cyclogenesis. Intensification and movement of the 500-mb low as a function of 500-mb height falls tendency is presented. Identification, intensification, and movement

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of the plain surface system is then introduced. Finally, the related developments at all levels of the atmosphere, as they occurred during the January 1975 blizzard, are shown.

3WW-TN-77-1 (AD-A054236) *Special Study: An Investigation of Low-Level Winds as Related to Paradrop Operations at Dyess Air Force Base, Texas*, by CMSgt. Eugene M. Weber, May 1978, 18pp. Dual theodolite pibals taken concurrently with combat control team mean effective wind calculations. Combat control team errors analyzed within selected ranges of mean effective wind: it was found that error increases significantly with increasing wind speed. Errors resulting from mean direction measurement were found to be insignificant. Similarly, aircraft positioning errors resulting from short term temporal variations were found to be insignificant when compared to speed measurement errors. Two methods of approximating mean effective winds introduced to provide a check against the larger CCT errors. Each method tested for accuracy against Dyess wind data. A simple estimation technique derived by the British Meteorological Office fit our data.

3WW-TN-77-2 (AD-A047423) *Case Study: A Report on the Storm System of 2 March 1971*, by CMSgt. Eugene M. Weber, November 1977, 50pp. This note uses storm of 2 March 1977 to verify empirical and subjective rules described in 3WW-TN-76-1, *Low Level Moisture Advection*, and 3WW-TN-76-2, *Major Snowstorm Development over the Midwest United States*. The sudden northward shift of this storm was in accordance with the rules previously presented. Note: Available in microfiche only.

3WW-TN-78-1 (AD-A048963) *Short Wave Fadeout (SWF) Equipment and Operational Procedures*, by Kenneth E. Eis, January 1977, 20pp. Explains the new AWS short wave fadeout (SWF) instrumentation, its installation, calibration, and use. Details of SWF observation discussed. Paper can be used by local equipment technicians as a technical order on SWF equipment until there is a formal Technical Order.

3WW-TN-79-1 (AD-A073432) *Moisture Advection and the Sangster Chart*, by Carl A. Johnson, June 1979, 48pp. Discusses clouds, precipitation, and upper low movements as they were observed to occur with certain type boundary layer moisture advection patterns. Moisture advection calculated using Sangster Chart winds and surface mixing ratios.

3WW-TN-79-2 (AD-A072746) *Major Midwest Snowstorms*, by CMSgt. Eugene M. Weber, August 1979, 104pp. Discusses various atmospheric conditions essential to development of major wintertime storm systems over midwest. Primary emphasis is on determination of areas favorable for cyclogenesis. Intensification and movement of 500-mb low as a function of 500-mb height falls tendency is presented. Identification, intensification, and movement of main surface system is then introduced. Finally, related developments of all levels of the atmosphere, as they occurred, are shown in various summary forms.

3WW/TN-80/001 (AD-none) *Index of 3WW Technical Notes and Forecaster Memos*, by Capt. James C. St John, January 1980, 6pp. This technical note lists all current technical notes and forecast memos published by 3WW Aerospace Sciences. This TN will be updated annually. Users may update this index when appropriate.

3WW/TN-80/002 (AD-A082125) *Comma Cloud Development Related to Major Winter Storms—Two Examples*, by CMSgt. Eugene M. Weber, March 1980, 15pp. Discusses relationship of comma cloud development over southern Rockies and Plains States to the developing storm system. Emphasis placed on likelihood that storm system will soon recurve northeastward when comma cloud becomes well-defined. Gives a brief look at the structure and development of the comma cloud. Includes two case studies. Microfiche copy available.

3WW/TN-80/003 (AD-A083564) *The Cheyenne Tornado; A METSAT Case Study*, by James C. St. John, March 1980, 13pp. Describes meteorological satellite (METSAT) imagery of a thunderstorm outbreak that produced the 16 July 1979 Cheyenne, Wyo., tornado. Discusses imagery signatures for severe weather, as well as application of METSAT imagery in providing weather support to other Air Force operations.

3WW/TN-81/001 (AD-A111956) *Satellite Interpretation*, by CMSgt. Eugene M. Weber, December 1981, 109pp. Describes cloud formations as seen on enhanced infrared and visible GOES satellite photographs; attempts to relate the meteorological causes for these formations. Some of the latest techniques developed by NESS are included. Designed to be used as a base reference for comprehensive training in analysis, interpretation, and application of satellite data in making forecasts. Includes more than 350 illustrations, most of them actual satellite photos.

3-7. 4WW TECHNICAL NOTES. The 4th Weather Wing no longer exists, however, during its existence a number of technical documents papers and technical memoranda was published (TPs and TMs—the period equivalents of “technical notes”) between 1963 and 1972. Archival copies of documents dated from 1969 through 1972 are on file at the AFWTL—some are available from DTIC. Only the documents dated 1963 through 1968 with AD-numbers are listed here. Refer all requests to the AFWTL, 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019.

4WW TP 63-1 (AD-685808) *A Method of Verifying Short-Period Categorical Change Forecasts (0-3 Hours)*, by Capt. Herbert A. Million and Joe S. Restivo, January 1963, 29pp. A multitude of forecast verification systems are in existence today that serve economic, administrative and scientific purposes. We are primarily interested in the scientific purpose, in analyzing forecast errors to determine their nature and possible cause. Once the problem areas have been identified, one can concentrate on technical improvement in these weak areas. Certain problem areas can be subjectively identified without the aid of a verification system. An organized verification system, however, will keep the detachment better informed of its technical capability and effectiveness, point out more specifically where technical improvement is needed, and provide useful information on the trend in forecast accuracy over a period of time.

4WW TP 63-2 (AD-296944) *An Objective Aid for Forecasting Ceilings Less Than 300 Feet and/or Visibilities Less Than 1 Mile at Geiger AFB, Washington*, by Thomas H. Simmonds, February 1963, 9pp. Forecasting the occurrence of operationally critical values of ceiling and/or visibilities presents a major problem at Geiger AFB, Wash. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-3 (AD-None) *The Effects of High Altitude Thermonuclear Explosions on the Weather*, by Capt. Herbert A. Million, February 1963, 8pp. This briefing was given to the Commanders and Staffs of NORAD and ADC in response to their questions regarding several newspaper and weekly new magazines articles.

4WW TP 63-4 (AD-None) *A Pilot Study of an Objective Aid for Forecasting Ceilings Less Than 300 Feet and/or Visibilities Less Than 1 Mile at Paine AFB, Washington*, by Thomas H. Simmonds, March 1963, 6pp. Forecasting the occurrence of operationally critical values of ceiling and/or visibilities presents a major problem at Paine AFB, Wash. This study was conducted to develop an aid for forecasting such critical values.

4WW TP 63-5 (AD-404502) *An Objective Aid for Forecasting Strong and Gusty Surface Winds*, by Thomas H. Simmonds, May 1963, 7pp. Forecasting the occurrence of operationally critical values of strong surface winds with accompanying gust presents a major problem at Grand Forks AFB, N.D. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-6 (AD-405683) *A Case History Investigation of Wintertime Storms which Produce Sustained Surface Winds 50 Knots or Greater at Texas Tower 2 and Texas Tower 3-Part 2 (Summary of Results)*, by Scientific Services Section, May 1963, 10pp. This report supplements our study, “A Case History Investigation of Winter Storms which Produce Sustained Surface Wind Speeds 50 knots or greater at Texas Tower 2 and Texas Tower 3,” and summarizes our forecasting experience on the tower forecasting project using the procedures outlined in the study. The study was published in September 1962. However, the forecasting procedures set forth in the study were completed on 18 December 1961 and were used as forecasting guides from that date.

4WW TP 63-7 (AD-406606) *An Objective Aid for Forecasting Strong and Gusty Surface Winds at Portland AFB, Oregon, (Revised May 1963)*, by Thomas H. Simmonds, May 1963, 4pp. Forecasting the occurrence of operationally critical values of strong surface winds with accompanying gusts presents a major problem at Portland AFB, Ore. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-8 (AD-408637) *An Objective Aid for Forecasting Strong and Gusty Surface Winds at McChord AFB, Washington (Revised May 1963)*, by Thomas H. Simmonds, May 1963, 4pp. Forecasting the occurrence of operationally critical values of strong surface winds with accompanying gusts presents a major problem at McChord AFB, Wash. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-9 (AD-408449) *An Objective Aid for Forecasting Strong and Gusty Surface Winds at Paine*

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AFB, Washington, by Thomas H. Simmonds, June 1963, 4pp. Forecasting the occurrence of operationally critical values of strong surface winds with accompanying gusts presents a major problem at Paine AFB, Washington. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-12 (AD-422281) *An Objective Aid for Forecasting Ceilings Less Than 300 Feet and/or Visibilities Less Than 1 Mile and Ceilings Less Than 1,500 Feet and/or Visibilities Less Than 3 Miles at Richards-Gebaur AFB, Missouri*, by Thomas H. Simmonds, October 1963, 8pp. Forecasting the occurrence of operationally critical values of ceiling and/or visibilities presents a major problem at Richards-Gebaur AFB, Mo. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 63-13 (AD-424954) *An Objective Aid for Forecasting Ceilings and Visibility at Sioux City AFS, Iowa*, by Thomas H. Simmonds, November 1963, 7pp. Forecasting the occurrence of operationally critical values of ceiling and/or visibilities presents a major problem at Sioux City AFS, Iowa. This investigation was conducted to develop an objective aid for forecasting such critical values.

4WW TP 64-1 (AD-None) *Verification of NMC/SAGE Wind Forecasts for July 1963*, by Joe S. Restivo and Capt. D. Barbarick, January 1964, 22pp. During the past few years, SAGE wind forecasting has undergone many improvements during the process of changing from a time-consuming manual technique at every sector station to the automated procedure used presently by the National Meteorological Center (NMC). Beginning in early 1963, NMC issued seven SAGE wind bulletins daily containing wind forecasts for each grid point from 5,000 to 60,000 feet. The increased frequency of SAGE wind bulletins is one of the major improvements during the past year. Another improvement, probably of equal importance, is the change in the atmospheric model used to produce NMC operational forecasts. The improved 3-level baroclinic model was introduced into the SAGE wind forecasting routine in 1963 and is believed to offer improvement over the former barotropic SAGE wind forecasts, especially at high altitudes. Information on the new NMC model was widely publicized by Air Weather Service in February 1962, and a description of the NMC/SAGE wind bulletins was published by Headquarters, 4th Weather Wing in September 1962.

4WW TP 64-2 (AD-None) *Verification of NMC/SAGE Wind Forecasts for October 1963*, by Joe S. Restivo and Capt. D. Barbarick, February 1964, 20pp. This report is the second of a series of verification studies on SAGE wind forecasts made at the National Meteorological Center (NMC) for use in SAGE sector weather stations. The first report was published as 4th Weather Wing Technical Paper 64-1 and dealt with verification statistics for July 1963. Subsequent studies for January 1964 and April 1964 will be published as Technical Papers 64-3 and 64-4 respectively. Technical Paper 64-1 contains a general discussion on the SAGE wind forecast system and the reasons for initiating the verification studies; therefore the reader is referred to this paper for necessary background information. The general purpose of this investigation is to obtain a quantitative measure of our wind forecast capability throughout the SAGE system which heretofore has not been sufficiently documented.

4WW TP 64-3 (AD-None) *Verification of NMC/SAGE Wind Forecasts for January 1964*, by Joe S. Restivo and Capt. D. Barbarick, January 1964, 21pp. This report is the third of a series of verification studies on SAGE wind forecasts made at the National Meteorological Center (NMC) for use in SAGE sector weather stations. The first two reports, published as 4th Weather Wing Technical Paper 64-1 and 64-2, dealt with verification statistics for July and October 1963. The study for April 1964 will be published as Technical Paper 64-4. Technical Paper 64-1 contains a general discussion on the SAGE wind forecast system and the reasons for initiating the verification studies; therefore the reader is referred to this paper for necessary background information. The general purpose of this investigation is to obtain a quantitative measure of our wind forecast capability throughout the SAGE system which heretofore has not been sufficiently documented.

4WW TP 64-4 (AD-None) *Part I-Verification of NMC/SAGE Wind Forecasts for April 1964, Part II-Summary of Verification Results for 1963-64*, by Joe S. Restivo and Capt. D. Barbarick, August 1964, 23pp. This is the fourth and final report of a series of verification studies on SAGE wind forecasts made at the National Meteorological Center (NMC) for use in SAGE sector weather stations. The first three reports, published as 4th Weather Wing Technical Paper 64-1, 64-2 and 64-3 dealt with verification statistics for July 1963, October 1963, and January 1964 respectively. Technical Paper 64-1 contains a general discussion on the SAGE wind forecast system and the reasons for initiating the verification studies; therefore the reader is referred to this paper for necessary background information. The

general purpose of this investigation is to obtain a quantitative measure of our wind forecast capability throughout the SAGE system that has not been sufficiently documented. One complete month of verification data for each quarter has now been evaluated and published. These evaluations will be used by NMC in their forecast improvement efforts. If and when new forecast models are introduced or new procedures are employed by NMC, we will again initiate a new verification project and publish results through technical papers of this type. This paper is divided into two parts. Part I presents the verification results for April 1964, similar to the previous three papers and Part II is a general summary of results for the entire year.

4WW TP 64-5 (AD-430508) *An Objective Aid for Forecasting Ceilings and Visibilities Less Than 500/1 at Colorado Springs, Colorado*, by Thomas H. Simmonds, January 1964, 9pp. Forecasting the occurrence of critical values of ceilings and visibilities presents a major problem at Colorado Springs, Colo. This investigation was conducted to develop objective aids for forecasting such critical values.

4WW TP 64-6 (AD-None) *An Objective Aid for Forecasting Ceilings and Visibilities at Sioux Falls (Foss Field) South Dakota*, by Thomas H. Simmonds, March 1964, 11pp. Forecasting the occurrence of operationally critical values of ceilings and/or visibilities presents a major problem at Sioux Falls (Foss Field). This investigation was conducted to develop objective aids for forecasting such critical values.

4WW TP 64-7 (AD-None) *Weather Tendency Reporting Program*, by Col. Alexander Kouts, July 1964, 27pp. A program for visually discerning impending changes to local weather conditions.

4WW TP 64-8 (AD-None) *Appraisal and Modification of NMC Prognostic Charts*, by Joe S. Restivo, July 1964, 16pp. Describes how to effectively utilize National Meteorological Center (NMC) prognostic charts, detachment forecasters should carefully appraise each chart in some organized and systematic manner.

4WW TP 64-9 (AD-None) *Spurious Radar Echoes Over Southwestern United States*, by Lt. Col. Richard C. Burriss and Capt. Eugene T. Gray, June 1964, 14pp. On 10 April 1964, 4th Weather Wing Scientific Services was requested to investigate the possibility of meteorological phenomena producing spurious echoes (targets) observed on radar

scopes at sites in the southwestern United States. This report reveals results of the investigation.

4WW TP 64-10 (AD-None) *Summer Human Comfort*, by Maj. Glenn C. Reiter, May 1964, 10pp. Each new summer brings its share of hot, sultry weather and accompanying human discomfort. The purpose of this report is to discuss the effects of heat on the human body, and to show some of the indexes that have been derived to measure or predict human comfort in terms of meteorological parameters.

4WW TP 64-11 (AD-None) *Radioactivity Fall-Out Plots*, by Lt. Col. Anthony L. Merlo, August 1964, 13pp. This report describes the AWS fall-out plot is a time-space plot that delineates the ground areas that might receive fall-out and the time of occurrence.

4WW TP 66-1 (AD-640074) *Persistence Probability*, by Joe S. Restivo, August 1966, 40pp. This paper consolidates many ideas--both published and suggested--concerning the use of persistence as a practical forecast tool. Specific emphasis is placed on the construction of ceiling and visibility persistence probability (or conditional probability) tables and suggested uses as a short-period forecast aid. The paper contains a survey of published literature available in the technical files of Headquarters, 4th Weather Wing and presents many ideas and suggestions for designing improved probability tables.

4WW TP 67-1 (AD-658038) *Onset-Duration Tables of Specified Ceiling and Visibility Categories*, by Joe S. Restivo, August 1967, 17pp. This paper describes a new type of table which shows for each initial ceiling (and visibility) category, frequency distributions of onset times, a duration history based on successive hours of occurrence and a complete history of the type and frequency of subsequent one-hour weather category changes.

4WW TP 67-2 (AD-None) *A Catalog of Selected Meteorological Studies Available from the Defense Documentation Center*, by Joe S. Restivo, October 1967, 11pp. This catalog contains two parts: Part I contains a list of general reference studies extracted from DDC TAB's and the USGRDR during the period 1 January 1962- 1 October 1967; Part II contains a list of specific terminal forecast studies extracted from DDC TAB's and the USGRDR during the period 15 December 1965-1 October 1967.

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4WW TP 68-1 (AD-830636) *Forecasting Solar Flares Using Calcium Plage History*, by Capt John W. Maurin, June 1967, 15pp. The probability of major solar flares (importance class 2 or greater) is compiled based upon the flare history of calcium plages.

4WW TP 68-2 (AD-830642) *A Simple Method for Calculating the East Limb Return Date of Solar Centers of Activity*, by MSgt Arthur R. Thomas, June 1967, 11pp. The method calculates the east limb return data of Solar Centers of activity, either plages or sunspots.

4WW TP 68-3 (AD-None) *An Investigation and Case History of Five Major Solar Flares that Occurred Unexpectedly*, by MSgt. Arthur R. Thomas, November 1966, 26pp. The report discusses five major solar flares that occurred unexpectedly. A unique method of plotting observed data and computing a solar region index is presented. The region index seems to be directly proportional to the importance class of these five major flares.

4WW TP 68-4 (AD-835210) *Solar Flare Prediction Using Calcium Plage Area, Sunspot Area, and Flare History*, by Capt. John W. Maurin and TSgt Delos A. DeForest, August 1967, 22pp. The probability occurrence of major solar flares (importance Class 2 or greater) is compiled based upon multiple correlation and regression analysis of calcium plage area, sunspot area, and flare history.

4WW TP 68-5 (AD-835750) *Solar Forecasting Aid The Activity Level Designator Chart*, by TSgt. Richard B. Agee, March 1967, 15pp. The Activity Level Designator Chart (ALDC) is designed to give a 24-hour percentage probability forecast of an importance two or greater solar flare from a selected region on the sun. The data used in this report was from September 1965 through January 1967. Updated ALDC's and techniques for forecasting solar flares can be found in later technical reports or in 4WWM 105-1.

4WW TP 68-6 (AD-None) *A Catalog of General Meteorological Studies and Local Forecast Studies*, by Joe S. Restivo and MSgt. Robert L. Helms, November 1968, 14pp. This catalog contains two parts: Part I contains a list of general reference studies extracted from DDC TAB's and the USGRDR during the period 1 January 1962-1 November 1968; Part II contains a list of specific terminal forecast studies extracted from DDC TAB's and the USGRDR during the period 15 December 1965- 1

November 1968. This paper supersedes 4WW TP 67-2 dated October 1967.

4WW TP 69-1 (AD-685808) *Climatic Atlas of North America Mean Winds*, by CMSgt. Donald T. Brissett and Clarence E. Everson, March 1969, 87pp. Provides monthly charts of mean winds at 10,000-foot intervals from 10,000 to 70,000 feet.

4WW TP 69-2 (AD-None) *Climatic Atlas of North American Flying Weather*, by CMSgt. Donald T. Brissett and Clarence E. Everson, May 1969, 41pp. Provides monthly percent frequency of three ceiling/visibility categories: less than 500/1, less than 1,000/3, and less than 5,000/5.

4WW TP 69-3 (AD-None) *Climatic Atlas of North America Temperature and Relative Humidity*, by CMSgt. Donald T. Brissett and Clarence E. Everson, August 1969, 64pp. Provides monthly charts of average maximum, average minimum, and average temperatures for North America. Also, includes monthly charts of average equivalent chill temperature and average relative humidity.

4WW TP 69-4 (AD-None) *Climatic Atlas of North American Precipitation*, by CMSgt. Donald T. Brissett and Clarence E. Everson, October 1969, 61pp. Monthly charts that show average precipitation, average number of precipitation days, average snowfall, average number of days with snowfall, and average precipitation per precipitation day for North America.

4WW TP 69-5 (AD-697960) *Visibility Improvement Graphs—A Synoptic Climatological Forecast Aid*, by Robert C. Sabin, November 1969, 24pp. Describes a new technique for producing a useful synoptic climatological forecast aid that is different from the conventional climatological product. Data is limited to a specific weather element (radiation fog) associated with a specific synoptic weather regime. It is probably the first true synoptic climatological forecast tool. Its superiority over aids that do not take the synoptic pattern into account is clearly evident.

4WW TP 70-1 (AD-703305) *The Value of Static and Trend Persistence in the One-Hour Prediction of Ceiling and Visibility*, by Joe S. Restivo and Capt Franklin R. Hartranft, February 1970, 122pp. Describes some applications of persistence by different weather agencies—identifies certain "areas of confusion" and

clarifies the definition of the term. Presents statistical evaluation of static and trend persistence based on period of record (POR) at seven terminals.

4WW TP 70-2 (AD-712678) *Computerized Map Typing Procedures and their Application to the Development of Forecast Aids*, by Franklin R. Hartranft, Joe S. Restivo, and Robert C. Sabin, August 1970, 57pp. This paper describes methods of classifying surfaces and upper air weather maps into map types through computer techniques, and various applications in the development of forecast aids. Specific emphasis is placed on three applications, namely: 1) case studies of special weather phenomenon, 2) objective forecast studies, and 3) synoptic climatological forecast aids. These applications are illustrated using actual results from several 4 WW projects.

4WW TP 70-3 (AD-709887) *Climatic Atlas of North America Mean Sea and Lake Surface Temperatures*, by Clarence E. Everson and CMSgt. Donald T. Brissett, June 1970, 46pp. Monthly charts of mean sea/lake surface temperatures for the Atlantic from North America to 30° W, for the Pacific from North America to 170° E, and for the Great Lakes.

4WW TP 70-4 (AD-715932) *A Glossary of AWS Terminology*, by John F. Gaillard, September 1970, 51pp. An historical reference to arcane AWS terminology, circa 1970; examples: continuous weather watch, MANAM, observing site.

4WW TP 70-5 (AD-718422) *Predicting Heavy Snowfall for Colorado Springs Based on Computer Derived Map Types*, by Franklin R. Hartranft, Joe S. Restivo, and Robert C. Sabin, December 1970, 211pp. This paper contains the results of applying the weather map typing procedures described in 4 WW Technical Paper 70-2, *Computerized Map Typing Procedures and*

Their Application in the Development of Forecast Aids, to the specific problem of heavy snow forecasting in Colorado Springs, Colorado. The case study technique described in SECTION IIIA of 4WW TP 70-2 was employed to derive sets of surface and 700-mb map forecast study technique described in SECTION IIIB of 4 WW TP 70-2 was used to develop a set of forecast aids (scatter diagrams) for each surface/700-mb map type. The snow study described in this paper demonstrates a new approach to objective forecast study development. The synoptic situation has been objectively integrated into the initial stratification of climatological data and therefore permits an objective consideration of surface and 700 mb map patterns as the initial step in the forecast procedure. The inclusion of climatologically derived map types in the forecast study also allows an excellent means of incorporating prognostic chart information.

4WW TP 71-1 (AD-723678) *Weather Radar Scope Interpretation*, by Capt. Robert J. Rice, Jr., April 1971, 61pp. Consolidates many ideas of the period on the interpretation and use of weather radar.

4WW TP 72-1 (AD-None) *Applying a Window Pane Technique to the Colorado Springs Snow Study*, by Lt. Col. Robert C. Sabin, January 1972, 19pp. This paper describes an attempt to zero-in on the small scale circulation by correlating only one corner of the large window. By typing the corner, or "window pane," it is possible to refine the snow forecasting technique.

4WW TP 72-2 (AD-744102) *A Comparison of Two Techniques Used to Develop a Computer Generated Map Type Catalog*, by Robert C. Sabin and R.L. Nieman, March 1972, 25pp. Tests and reports upon two methods used to develop map types for inclusion in the computerized terminal forecast program; concludes that the two methods are interchangeable.

3-8. 5WW TECHNICAL NOTES. The 5th Weather Wing no longer exists, however, during its existence, several technical notes were published. The AFW Technical Library (AFWTL) has the technical notes listed below. To order a copy, contact the AFWTL, 151 Patton Ave., Room 120, Asheville NC 28801-5002, DSN 673-9019.

5WW-TN-71-1 (AD-718111) *Systematic Errors of Numerical Progs*, March 1971. A reprint of NWS Central Region Technical Attachment 71-1.

5WW-TN-71-2 (AD-724679) *Forecasting Air Mass Thunderstorms at Nellis AFB, Nevada*, by Leonard D. McChesney, May 1971, 11pp. The paper describes an objective method for forecasting air mass thunderstorms at Nellis AFB, Nev. It uses the YUCCA flats 1200Z ROAB data, and the average heating curves to arrive at the forecast.

5WW-TN-71-4 (AD-728627) *Henz Lee Slope Thunderstorm Study for Buckley ANG Base Aurora, Colorado*, by John F. Henz, August 1971, 18pp. This note concentrates on the deviation of an objective yes/no thunderstorm forecast technique within a 12 mile radius of Buckley ANG Base, Colo.

5WW-TN-71-5 (AD-730327) *Mesoscale Analysis and Forecasting*, by Maurice E. Pautz, September 1971, 42pp. A collection of mesoscale analysis and forecasting techniques to aid the station forecaster in making improved short-range forecasts. These techniques include plotting and analysis of the pressure, temperature, streamline and upper-air fields with methods to use these fields for forecasting. Even though these methods are not new this manuscript brings all the current techniques into one collection.

5WW-TN-72-1 (AD-735276) *The Use of Diurnal Temperature and Dew Point Curves*, by Lt. Col. Stanley J. Kimball, Capt. Norman N. Richardson, and Capt. Dean H. Frey, January 1972, 24pp. Describes basic design of computer-produced diurnal temperature and dew point tables and graphs, and their use in short-range forecasting.

5WW-TN-72-2 (AD-744521) *The Use of Wind Stratified Conditional Climatology Tables*, by Ronald F. Madsen, June 1972, 18pp. The paper describes the design of computer produced wind stratified conditional climatology tables and their use in short-range forecasting.

5WW-TN-72-3 (AD-None) *Forecasting Gusty Surface Winds at Nellis AFB, Nevada*, by Leonard D. McChesney, July 1972, 20pp. This study discusses the measurement of sea level and upper-air gradients to determine the strength of the wind field at Nellis AFB, Nev.

5WW-TN-78-1 (AD-A051036) *The Use of Wind Stratified Conditional Climatology Tables*, by Capt. Stephen N. Horn and Capt. Joseph J. Butchko, February 1978, 19pp. Describes design of computer-produced wind stratified conditional climatology tables, and their use in short-range forecasting.

5WW-TN-78-2 (AD-A056988) *Tailored Climatology of Severe Weather*, by Robert P. Wright, June 1978, 16pp. This technical note describes the design and use of computer-produced climatologies of severe weather reports within 50 statute miles of a given location.

5WW/TN-79/001 (AD-Unknown) *Minimum Sea Surface Temperature and Associated Survival Times*, by Technical Sergeant Gerald L. Wheeler, May 1979, 25pp. Contains sea-surface temperature isotherm charts showing the approximate survival times of humans immersed in the waters of the North Atlantic and North Pacific Oceans. Minimum sea-surface temperatures are based on the 95th (North Atlantic) and 97.5th (North Pacific) percentiles.

5WW/TN-79/002 (AD-A070925) Superseded by 5WW/TN-87/001, December 1987.

5WW/TN-83/001 (AD-A131892) *World-Wide Sea-Surface Temperatures*, by Capt. John K. Sanders, Ransom R. Traxler, and TSgt. Gerald L. Wheeler, April 1983, 254pp. Contains sea-surface isotherm charts divided into geographical sections for the Atlantic, Pacific, and Indian Oceans as well as North American lakes and Hudson Bay. Each section further divided into 12 monthly sets of charts, each containing a maximum, mean, and minimum temperature chart (except for the Canadian Lakes and Hudson Bay section, which gives only a mean value). Also includes a table of approximate survival times for humans with ordinary clothing immersed in sea.

5WW/TN-84/001 (AD-A148W9) *Computing Worldwide Sunrise, Sunset, Moonrise, Moonset, and Twilight Times Using 5WWPs 105-3 and 105-4*, by Lt. Col. Kenneth W. Hertzler, July 1984, 8pp. Describes technique for calculating times for sunrise/set, moonrise/set, and twilights. Requires use of 5WWPs 105-3 and 105-4 as data sources.

5WW/TN-84/002 (AD-None) *Forecasting Air Mass Thunderstorms at Nellis AFB, Nevada*, by Leonard D. McChesney (updated by 5WW/DNS), November 1984, 10pp.

5WW/TN-86/001 (AD-A175176) *Southwest Asia Forecaster Handbook*, by Maj. Richard G. Peer, August 1986, 95pp. Prepares forecasters for weather to expect

when deployed or assigned to Southwest Asia. Discusses Syria, Lebanon, Jordan, Israel, Iran, Afghanistan, Iraq, and the Arabian Peninsula. Divided into seasons for convenience.

5WW/TN-87/001 (AD-A190777) *Computing Basic Solar and Lunar Data from the Air Almanac*, by Capt. John K. Sanders and TSgt. Charles R. Elliott, updated by MSgt. George T. Gilligan, Jr., December 1987. Provides programmed instruction on use of Air Almanac to compute times of sunrise, sunset, moonrise, moonset, and duration of civil twilight for any location between latitudes 60 degrees south and 90 degrees north. Errata (provided in 20 April 1989 5WW/DNC letter) corrects nautical twilight estimation instructions on Page 15.

3.9 7WW TECHNICAL NOTES. The 7th Weather Wing no longer exists; however, during its existence, several technical notes were published. The Air Force Weather Technical Library (AFWTL) has the technical notes listed below. To order a copy, contact the AFWTL, 859 Buchanan Street, Scott AFB, IL 62225-5118, DSN 576-5023/5061.

7WW/TN-80/001 (AD-A086151) *Forecast Worksheet—A New Approach*, May 1980, 22pp. Forecasters are given mixtures of centralized forecasting guidance for various models, techniques, and data bases valid for varying times or time intervals and presented in many different ways. To produce an operationally sound forecast, they must logically assemble the various bits and pieces, resolve all inconsistencies, and visualize the interactive changes that will be taking place in the atmosphere. This report describes the results of a study of worksheets normally used by AWS units to prepare forecasts. It identifies weaknesses in many worksheets and describes a new format that provides a more logical step-by-step process for preparing forecasts.

7WW/TN-80/002 (AD-A087023) *Satellite Derived Winds*, July 1980, 14pp. Explains how satellite-derived winds are produced: discusses reliability and accuracy of satellite winds, gives possible uses, and provides instructions for decoding TWXX-series bulletins. Identifies differences in decoding procedures for U.S., Japanese, and European GOES wind bulletins. Gives example of bulletin and shows how data may be plotted.

7WW/TN-82/001 (AD-A118432) *Ray-Tracing Analysis of a Line-of-Sight Communications Path*, by Maj. James W. Goldey, May 1982, 28pp. Describes a

ray tracing technique used to examine causes of problems with a line-of-sight microwave link between Feldberg and Adenau, Germany, during the winters of 1975-76 and 1976-77. Use of the technique with various model atmospheres helped determine the significance of refractive bending and the location of radio holes. Estimates of depth of resulting fades showed that, on the average, fade was not significant. Results showed that fade can be expected whenever surface-based trapping layers extend to 1,800 feet MSL. Antenna decoupling, another possible problem source, was not examined in this study.

7WW/TN-82/002 Rescinded.

7WW/TN-82/003 (AD-A149714) *Ability of the AFGWC Boundary Layer Model to Detect and Predict Anomalous Propagation*, by Maj. James W. Goldey, May 1982, 20pp. Documents results of a study to (1) determine ability of a computer-generated analysis of atmospheric refraction to detect and predict anomalies in performance of tropospheric scatter communications links, and (2) verify skill with which vertical profiles of atmospheric refraction were forecast for 12 hours. Discusses the need for a capability to remotely analyze and forecast refractivity, gives advantages and disadvantages of technique used to satisfy the need.

Catalog of Air Force Weather Technical Documents

Chapter 4

FORECASTER MEMOS

The first forecaster memo appeared in mid-1979. The rationale for its creation is best explained by the following note, which appeared in the last (March 1979) issue of the AWS Aerospace Sciences Review, AWSRP 105-2:

"The March 1979 issue of the Aerospace Sciences Review is the last one. Air Weather Service will publish an informal, aperiodic publication entitled "Forecaster Memo" in place of the Aerospace Sciences Review.

The revised AWSR 80-2, which you should receive during April 1979, will prescribe the "Forecaster Memo." This publication will be used to disseminate articles on forecasting as they become available. Our thanks to all of you who supported and contributed to the Aerospace Sciences Review over the past 20 years."

FMs were used for fast and informal dissemination of analysis and forecasting procedures or other technical information. FMs are not in technical publication format. Most are not registered at DTIC and do not have AD-numbers. Consequently, they are not included in the DTIC database and are not routinely available to other Department of Defense agencies.

4.1 AIR WEATHER SERVICE FORECASTER MEMOS. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

AWS/FM-79/001 *30 Rules for Supervisors*, July 1979, 5pp.

AWS/FM-79/009 *Extended Range Temperature Forecasts*, by 7WW/DON, September 1979, 2pp.

AWS/FM-79/002 *Short Range Forecasting*, July 1979, 1p.

AWS/FM-79/010 *Aircraft Icing over Northwest Europe*, by Holt Ashley, November 1979, 5pp.

AWS/FM-79/003 *Some Management Practices in USAF Weather Stations*, by Kenneth E. German, July 1979, 2pp.

AWS/FM-79/011 *Visibility Deterioration Caused by Successive Takeoffs of Jet Aircraft*, by Herbert S. Appleman, December 1979, 4pp.

AWS/FM-79/004 *On the Relationship of Severe Weather to Radar Tops*, by Roy P. Darrah, July 1979, 8pp.

AWS/FM-80/001 *Frequently Asked Questions about FXUX*, by Maj. Frank Globokar, January 1980, 4pp.

AWS/FM-79/005 *Diurnal Variation of Precipitation*, undated, 4pp.

AWS/FM-80/002 *On the Relationship of Severe Weather Types to the Strength of the Tropopause*, by Roy P. Darrah, February 1980, 2pp.

AWS/FM-79/006 *Precipitable Water over the U.S.*, July 1979, 5pp.

AWS/FM-80/003 *Mesocyclone and Severe Thunderstorm Structure: A Revised Model*, by Leslie R. Lemon and Charles A. Doswell III, February 1980, 6pp.

AWS/FM-79/007 *A Subjective Assessment of Model Initial Conditions Using Satellite Imagery*, by John E. Hales, Jr., undated, 6pp.

AWS/FM-80/004 *Tornado and Severe Thunderstorm Warning Verification*, by Allen Fearson and Clarence L. David, February 1980, 2pp.

AWS/FM-79/008 *Training Guide for Severe Weather Forecasters*, by Charlie A. Crisp, not dated, 6pp. (Excerpted from AFGWC TN 79-002).

AWS/FM-80/005 *Description of Automated Fog Forecasts*, by Capt. David M. Garrison, February 1980.

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AWS/FM-80/006 *The Thompson Stability Index*, by SMSgt. Larry Thompson, February 1980, 2pp.

AWS/FM-80/007 *AWSTR 200 Review*, by MSgt. John J. Slaby, Jr., June 1980, 8pp.

AWS/FM-80/008 *Production Unit Quality Control (AWSR 178-1)*, by CMSgt. Charles Lee, July 1980, 4pp.

AWS/FM-81/001 *Mesoscale Surface Analysis of the 10 April 1979 Tornadoes in Texas and Oklahoma*, by Allan R. Moller, February 1981, 8pp.

AWS/FM-81/002 *AWS Ceiling and Visibility Verification*, by Col. Kenneth E. German, April 1981, 8pp.

AWS/FM-81/003 *Electrooptical System Performance Programs (TV and Infrared)*, March 1981, 25pp.

AWS/FM-81/004 *Attenuation Problems Associated with a 5 cm Radar*, by Capt. Robert H. Allen, March 1981, 3pp.

AWS/FM-81/005 *Data Problems in the LFM, NMC*, March 1981, 3pp.

AWS/FM-81/006 *Calculating Toxic Corridors, Solar Elevation Angle Estimation*, May 1981, 3pp.

AWS/FM-81/007 *Refresher on Atmospheric Dispersion Fundamentals and Forecasting*, by Lt. Col. James L. Dicke and Capt. Jon P. Kahler, December 1981, 23pp.

AWS/FM-82/001 *A Logic Sheet to Assist Forecasting Thunderstorms and Severe Thunderstorms*, by J.R. Colquhoun, February 1982, 6pp.

AWS/FM-82/002 *Forecasting Severe Thunderstorms: A Brief Evaluation of Accepted Techniques*, by Dr. Robert A. Maddox and Charles A. Doswell III, February 1982, 5pp.

AWS/FM-82/003 *Hurricane-Induced Tornadoes*, by David J. Smalley, February 1982, 5pp.

AWS/FM-82/004 *A Technique for Forecasting Heavy Precipitation in the Southeastern United States*, by R.J. Soptei and W. H. Henry, February 1982, 8pp.

AWS/FM-82/005 *Satellite and Surface Observations of Strong Wind Zones Accompanying Thunderstorms*, by James J. Gurka, March 1982, 4pp.

AWS/FM-82/006 *Mesoscale Convective Complexes*, by Dr. Robert A. Maddox, March 1982, 19pp.

AWS/FM-82/007 *Trough Analysis and Depiction on Upper-Air Charts*, April 1982, 8pp. From 5WW "Newsletter," April 1982, 8pp.

AWS/FM-82/008 *Estimating Thermal Contrast for Infrared (8-12 NM) Electrooptical Systems*, by Maj. Richard R. Babcock, Jr., and Maj Robert P. Wright, March 1982, 15pp.

AWS/FM-82/009 *Relationship Between Cloud Bands in Satellite Imagery and Severe Weather*, by Samuel K. Beckman, April 1982, 5pp.

AWS/FM-82/010 *Comparisons of Heat Stress Indexes*, by Robert Quayle and Fred Doehring, April 1982, 5pp.

AWS/FM-82/011 *Model Output Statistics (MOS) References*, by Maj. Robert E. Peterson, April 1982, 3pp.

AWS/FM-82/012 *Wave Clouds and Severe Turbulence*, by Samuel K. Beckman, June 1982, 9pp.

AWS/FM-82/013 *Diffusion Predictions for Chemical Defense*, by Maj. John P. Kahler and Lt. Col. J. L. Dicke, June 1982, 14pp.

AWS/FM-82/014 *Verification of MOS Guidance for Cloud Amount, Ceiling, and Visibility*, by Maj. Kenneth A. Peterson, August 1982, 9pp.

AWS/FM-82/015 *Water Vapor Depiction—A Minimum Temperature Aid*, by John A. Jannuzzi, October 1982, 4pp.

AWS/FM-83/001 *The Year of the Tornado*, by Edward W. Ferguson, Joseph T. Schaefer, Steven J. Weiss, and Larry F. Wilson, March 1983, 11pp.

AWS/FM-83/002 *Thunderstorms*, by the Federal Aviation Administration, April 1983, 8pp.

AWS/FM-83/003 *The Icelandic Low and an Effect on Aviation*, by Maj. Ed Jenkins, undated, 4pp.

AWS/FM-83/004 Mesoscale Convective Complexes and General Aviation, by R.A. Maddox and J.M. Firtsch, May 1983, 7pp.

AWS/FM-83/005 Mesoscale Convective Complexes over the United States During 1981—Annual Summary, by R.A. Maddox, D.M. Rogers, and K.W. Howard, June 1983, 15pp.

AWS/FM-83/006 Satellite Depiction of the Life Cycle of a Mesoscale Convective Complex, by Robert A. Maddox, June 1983, 5pp.

AWS/FM-83/007 El Niño, July 1983, 4pp.

AWS/FM-83/008 Summary of Some Recent Lightning Phenomena Research Investigations, by Lt Col. James L. Dicke, August 1983, 24pp.

AWS/FM-83/009 Operational Infrared Weather Forecasting Support—Lessons Learned During the IR Maverick IOT & E, by Lt. Col. Robert P. Wright, September 1983, 21pp. Other request for this document must be referred to Hq AWS/DOZ. **WARNING:** This document contains information for manufacturing or using weapons of war. Export of the information contained herein, or release to foreign nationals within the United States without first obtaining an export license is a violation of the International Traffic-in-Arms Regulation. Such violation is subject to a penalty of up to 2 years imprisonment and a fine of \$100,000 under 22 USC 2778.

AWS/FM-83/010 The Reliability of the Bow Echo as an Important Severe Weather Signature, by Ron W. Przybylinski and William J. Gery, November 1983, 7pp.

AWS/FM-84/001 Defense Meteorological Satellite Program (DMSP), by Maj. Gerard D. Wittman, June 1984, 25pp.

AWS/FM-84/002 Microburst Wind Shear, by John McCarty and Tetsuya T. Fujita, May 1984, 35pp.

AWS/FM-85/001 The Forecast Sounding, by MSgt. Fred Gesser and MSgt. Dave Wallace, January 1985, 13pp.

AWS/FM-85/002 Severe Weather Test...Part 1: Theory, by MSgt. Fred Gesser, April 1985, 10pp.

AWS/FM-85/003 Severe Weather Test...Part 2: Analysis, by MSgt. Fred Gesser, April 1985, 8pp.

AWS/FM-85/004 Severe Weather Test...Part 3: METSAT, by MSgt. Fred Gesser, April 1985, 8pp.

AWS/FM-85/005 Severe Weather Test...Part 4: Radar, by MSgt. Fred Gesser, May 1985, 8pp.

AWS/FM-85/006 Not used.

AWS/FM-85/007 NWP Models at a Glance, by Maj. Gregory D. Nastrom, December 1985, 17pp. Discusses benefits to be gained from knowledge of common NWP models. Reviews basic model components and describes main features of NWP models in use or planned at AFGWC, NMC, and FNOG.

AWS/FM-85/008 Calendar of the Nighttime Global Illuminance for the Prediction of Nighttime Intensity of Light, by the Office for Armed Forces Geophysics, Traben-Trarbach, Germany, translated by Capt. Dennis Frill, 7th WS, December 1985, 10pp. *Distribution authorized to DoD components only, foreign government information, 1 August 1985. Other requests for this document must be referred to AWS/DOZ, SCOTT AFB, IL 62225-5008.*

AWS/FM-86/001 Creating Instant Experience..., or, How to Make a Forecast Study, by Maj. Gregory D. Nastrom, May 1986, 6pp. A short discussion of what a forecast study is and how to do one.

AWS/FM-86/002 Local and Regional Influences on the Meteorology of Central America, by Lt Col. Charles P. Guard, September 1986, 27pp. Applies tropical meteorological principles to Central America, stressing physical rationale for sensible weather and discussing effects of Central American geography on weather and climate.

AWS/FM-87/001 Forecasting the Atemporalado in Honduras, by MSgt. Bruce Brooks, February 1987, 9pp. In the dry winter season of Central America, the occasional southward penetration of cold fronts or shear zones create significant problems for aviation because of strong and gusty surface winds. This FM gives forecasters a simple index for predicting the onset of these mid-latitude intrusions and the sensible weather associated with them.

AWS/FM-87/002 *The NGM Numerical Output*, by 1st Lt Jeffrey Tongue, July 1987, 8pp. Output from the Nested Grid Model (NGM) is the primary numerical guidance used in the CONUS. This FM explains information provided in the NGM output. Explains "sigma" level, provides plotting worksheet.

AWS/FM-88/001 *REFRACTIVITY: New Uses for an Old Idea*, by Maj. Gregory D. Nastrom and Capt. Arthur C. Meade, April 1988, 14pp. Designed to help acquaint forecasters with refractive effects through a basic review of the refraction phenomenon and discussion of the Integrated Refractive Effects Prediction System (IREPS).

AWS/FM-90/001 *New Stability Indices and Fog Forecasting Techniques*, February 1990, 3pp. Describes four new stability indices and three new fog forecasting techniques scheduled for eventual inclusion in the revised AWS/TR-79/006, *The Use of the Skew T, Log P Diagram in Analysis and Forecasting*.

AWS/FM-90/002 *A New Method for Constructing the Pressure-Altitude (PA) Curve on the Skew T, Log P Diagram*, June 1990, 4pp. Describes a new method for plotting the pressure-altitude (PA) curve described in Paragraph 3.7, AWS/TR-79/006, "The Use of the Skew T, Log P Diagram in Analysis and Forecasting."

AWS/FM-90/003 *The Climate of Iran*, by Ghodrattollah "Jim" Soltani, September 1990, 10pp. Complements USAFETAC/TN-88/002, *The Persian Gulf Region--A Climatological Study*, May 1988.

AWS/FM-90/004 *The Climate of Iraq and the Arabian Peninsula*, by Mr. Ghodrattollah "Jim" Soltani, September 1990, 19pp.

AWS/FM-91/001 *Lightning Hazards and Lightning Detection Systems*, by Lt. Col. Gregory D. Nastrom, USAFR, June 1991, 16pp. Summarizes and describes the latest results of lightning hazard research, particularly as it applies to aircraft and space vehicles.

AWS/FM-92/001 *A New Severe Thunderstorm Identification Technique*, by Capt. David I. Knapp, February 1992, 7pp. Describes a new method (developed by AFGWC with data from the spring 1991 thunderstorm season) for identifying severe thunderstorms. The techniques uses lightning strike data from the National

Lightning Detection Network. The memo describes AFGWC's success with identifying severe thunderstorms. It also provides a rule of thumb for determining tornado potential from lightning flash data.

AWS/FM-92/002 *Using Hodographs in Thunderstorm Forecasting*, by Lt. Col. Gregory D. Nastrom, September 1992, 20pp. Describes a method (called a "hodograph") for displaying vertical wind profiles and using those profiles to forecast severe storms. Vertical wind profiles can help identify conditions that indicate the likelihood of severe storms. They can even identify the type of storm anticipated; for example, supercell, multicell, and splitting storms.

AWS/FM-92/003 *Verification of a Severe Thunderstorm Identification Technique*, by Capt. David I. Knapp, October 1992, 5pp. Provides verification data for Rule of Thumb #1 given in AWS/FM-92/001, above. The author verified the rule using late spring data (1 June to 10 July 1991). Initial verification included Red, Blue, and Green observations, but to really test the severe weather forecasting accuracy of the technique, statistics were recalculated using only Red and Blue reports; Green reports were considered "non-severe." Finally, data from late spring 1991 and early-to-middle spring 1992 was combined to create a spring seasonal database from early March to early July. This provided a full season's statistics with which to validate the technique's accuracy and determine the geographic distribution of positive strike dominated (PSD) cells.

AWS/FM-92/004 *Timing Thunderstorms and Convective Wind Gusts in West Central Florida Based on the Position of the Bermuda High-Pressure Ridge Axis*, by 1st Lt. William E. Kirk, October 1992, 5pp. Describes a new method for timing the first occurrence of thunder at MacDill AFB, in west-central Florida. MacDill averages 84 days a year with thunderstorms, more than any other Air Force base in the United States. About 83 percent of these thunderstorms occur during the summer (May to September). The new technique is based on the position (north or south of MacDill) of the 1,560-meter contour line on the 850 hPa 1200 UTC analysis.

AWS/FM-93/001 (AD-A290986) *The Basics of Weather Models*, by Dr. W. Dale Meyer, March 1993, 15pp. Summarizes the history and fundamentals of

modern numerical weather prediction models for operational weather forecasters. The information is intended to help forecasters understand the models' strengths and weaknesses. It is published with the expectation that an increased understanding of the details of these complex mathematical models will help forecasters make better use of NWP model forecasts. This FM complements information in Chapter 7, AWSP 105-56, "Meteorological Concepts."

AWS/FM-94/001 (AD-B196769) *Estimating IR Visibility from an "Austere" OTDA (Electrooptical Tactical Decision Aid)*, by Capt. Cliff Dungey, February 1994, 13pp. Tells Air Force weather forecasters how to estimate infrared visibility (IRVIS) that can, in a pinch, be substituted for values calculated by the more sophisticated and more accurate computer-derived electrooptical tactical decision aid (EOTDA). This memo shows how to enter estimated values of target dew point and visibility into graphs prepared for several types of general weather conditions. The "austere" EOTDAs provided by these graphs are based on calculations of atmospheric conditions for an average IR sensor. IRVIS is simply a distance index of IR transmissivity. The results produced by the graphs should be used only to provide very rough estimates of IR visibility when a computer-derived EOTDA is not available. ***Distribution limited to DoD components only; critical technology,***

July 1992. Other requests for this document must be forwarded to AFWA STINFO, 151 Patton Ave., Asheville NC 28801-5002. Warning: This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq) or the Export Administration Act of 1979 as amended, Title 50, U.S.C., App 2401, et seq. Violations of these export laws are subject to extreme criminal penalties.

AWS/FM-95/001 (AD-A302317) *Improved Altimeter Settings for A-10 Aircraft*, by Capt. Timothy D. Oram, February 1995, 15pp. Describes a process designed to improve the bombing accuracy of A-10 aircraft equipped with the Low Altitude Safety and Targeting Enhancement (LASTE) system by improving altimeter setting accuracy. After finding unacceptable altitude errors during tests of LASTE Version 3.3, the 57th Test Group (57th TG) at Nellis AFB, Nev., asked the 57th OSS/OSW to develop a method for improving A-10 bombing accuracy by developing improved altimeter setting forecasts. The 57 TG also contracted for General Electric to include software in LASTE Version 4 to correct for these altitude errors automatically. This memo describes a method for improving altimeter setting forecasts in support of LASTE Version 3.3. It also explains basic altimetry theory and tells how theory relates to the A-10 bombing problem. Finally, the memo provides tips for supporting LASTE Version 4.

AWS/FM-100- and 200-SERIES. The AWS 100- and 200-series forecaster memos were originally intended to familiarize AFW people with the "climate/weather regimes" of selected geographical areas, notably Africa and Asia.

AWS/FM-100/001 *Climate and Weather of Africa*, March 1980, 6pp.

AWS/FM-100/002 *Historical Listing of Country Names*, March 1980, 8pp.

AWS/FM-100/003 *Climate and Weather of North Africa*, March 1980, 30pp.

AWS/FM-100/004 *Climate and Weather of Mali/Niger/Chad/Sudan*, March 1980, 18pp.

AWS/FM-100/005 *Climate and Weather of the Guinea Coast*, March 1980, 32pp.

AWS/FM-100/006 *Climate and Weather of Tropical East Africa*, March 1980, 36pp. (Change 1, undated)

AWS/FM-100/007 *Climate and Weather of the Congo Basin*, March 1980, 20pp.

AWS/FM-100/008 *Climate and Weather of Southern Africa*, March 1980, 31pp.

AWS/FM-100/009 *Climate and Weather of the Arabian Peninsula*, March 1980, 42pp.

AWS/FM-100/010 *Climate and Weather of South Asia*, March 1980, 30pp.

AWS/FM-100/011 *Climate and Weather of the Eastern Mediterranean Countries*, March 1980. 58pp (Change 1).

AWS/FM-100/012 *Climate and Weather of Iraq, Iran, Afghanistan*, March 1980, 51pp.

AWS/FM-100/013 *Weather Support to Electrooptical Weapons Systems*, March 1980, 5pp. *Distribution limited to U.S. Government agencies only; Administrative/Operational Use, 27 March 1984. Other requests for this document must be referred to HQ AFWA/DN. WARNING: Information subject to export control laws. This document may contain*

information subject to the International Traffic in Arms Regulation (ITAR) or the Export Administration Regulation (EAR) of 1979 which may not be exported, released, or disclosed to a foreign national inside or outside the United States without first obtaining an export license. A violation of the ITAR or EAR may be subject to a penalty of up to 10 years imprisonment and a fine of \$100,000 under 22 U.S.C. 2778 or Section 2410 of the Export Administration Act of 1979. Include this notice with any reproduced portion of this document.

AWS/FM-100/014 *Propagation Climatology*, May 1980. 38pp. Approved for public release; distribution is unlimited.

AWS/FM-100/015 *The Effects of Desert on Man and Machine*, August 1980, 8pp.

AWS/FM-100/016 *MEAFSA Forecasting Hints*, August 1980, 42pp. (Change 2, 1p.).

AWS/FM-100/017 *Winter Shamal in the Persian Gulf*, August 1980, 58pp.

AWS/FM-100/018 *Low-Level Jet of the Western Indian Ocean*, August 1980, 30pp.

AWS/FM-100/019 *The Easterly Jet Stream in the Tropics*, September 1980, 7pp.

AWS/FM-100/020 *Forecasting Techniques in East Africa*, undated, 36pp.

AWS/FM-100/021 *Conditions for a Severe Dust Storm and a Case Study for Iraq*, undated, 10pp.

AWS/FM-100/022 *Heavy Rain in the Middle East Related to Unusual Jet Stream Properties*, April 1984, 4pp.

AWS/FM-200/001 *Climate and Weather of Central America*, March 1981, 27pp.

AWS FM 300-SERIES. *Single Station Analysis and Forecasting.* This series provides background reference materials for forecasting the weather with only limited observational data.

AWS/FM-300/001 *Single Station Analysis of Surface Observations*, by 1st Lt. Jeffrey S. Tongue, January 1987, 29pp. Tells how to develop an understanding of the current three-dimensional synoptic weather situation from a single surface observing location.

AWS/FM-300/002 *Single Station Analysis of Upper Air Observations*, by Capt. Jeffrey S. Tongue, April 1988, 13pp. Tells how to develop upper-air data for use in single-station forecasting.

AWS/FM-300/003. Not Used.

AWS/FM-300/004 *Diagrams, Charts, and Other Information for Performing Single Station Analysis and Forecasting in the Field*, June 1988, 14pp. A miniaturized collection of single-station forecasting aids (charts, tables, diagrams, formulas).

AWS/FM-300/005 *Conversion Tables, Miscellaneous Charts*, May 1983, 47pp. A handy, pocket-sized collection of frequently used tables and charts.

AWS/FM-600-SERIES. *Severe Convective Weather.* This series of forecaster memos was inspired by the experiences and recommendations of the Severe Weather Assistance Training (SWAT) teams that visited AWS units from January through April 1984.

AWS/FM-600/001 *Introduction to the Air Weather Service Convective Weather Forecaster Series*, by 1st Lt. John Pino, February 1987, 3pp.

AWS/FM-600/002 *Upper Air Analysis and Severe Weather Forecasting*, by MSgt. Fred Gesser, February 1987, 18pp.

AWS/FM-600/003 *Analyzing the Surface Map for Severe Convective Weather*, by 1st Lt. John Pino, February 1987, 6pp.

AWS/FM-600/004 *The Automated Radar Summary—An Aid to Convective Weather Forecasting?*, by 1st Lt. John Pino, February 1987, 11pp.

AWS/FM-600/005 *Synoptic Scale Applications of Satellite Imagery to Severe Convective Weather: Numerical Model Initialization Techniques and*

***Interpretation Guidelines*,** by 1st Lt. John Pino, February 1987, 21pp.

AWS/FM-600/006 *Assessing Severe Convective Weather Threat Potential—A Case Study Exercise, Part I*, by 1st Lt. John Pino, February 1987, 44pp.

AWS/FM-600/007 Not Used.

AWS/FM-600/008 *The Forecast Sounding*, by MSgt. Fred Gesser and MSgt. Dave Wallace, January 1985, 13pp. Note: This FM was created by the addition of a new cover sheet to AWS/FM-85/001.

AWS/FM-600/009 *The Local Area Work Chart*, by 1st Lt. John Pino, July 1987, 14pp.

AWS/FM-600/010 *Convection—A Selective Process? One Kilometer Resolution Satellite Interpretation*, by 1st Lt. John Pino, June 1987, 23pp.

4-2. AFGWC FORECASTER MEMOS. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

AFGWC/FM-81/001 *Meteorological Analysis and the LFM; They Work Together*, by MSgt. William R. Matley, April 1981, 24pp. Provides basic guidelines for use of the LFM in progging frontal systems, occlusions, etc. Discusses features such as the "exploding triple point," the Hatteras Low, and Arctic frontal placement.

AFGWC/FM-82/001 *Numerical Weather Prediction: Fundamentals and Operational Use at Meteorological Centers*, by Maj. Terry C. Tarbell, February 1982, 19pp. Explains weather analysis and prediction for manager/forecasters who don't need equations and extensive detail. Gives five papers on basics of numerical weather prediction (NWP), its major problems, and ongoing development activities.

AFGWC/FM-82/002 *Space Science Workbook*, by Maj. Ray E. Townsend, April 1982, 204pp. Complements the Sourcebook of the Solar Geophysical Environment. Provides outline and objectives for Space Environmental Forecaster Course by combining course notes and exercises.

AFGWC/FM-84/001 *Trajectory (FJ) Bulletins Fundamentals and Operational Use*, by TSgt. Michael D. Fett, July 1984, 28pp. Describes format, computation procedure, and limitations of the AFGWC trajectory bulletins, with emphasis on production methods.

AFGWC/FM-84/002 *3DNEPH Chronology*, edited by Charles W. Cook, July 1984, 46pp. A chronology of significant 3DNEPH events from 1 January 1972 to 31 July 1983. Provides insight into which years and geographical areas are most likely to contain good data. Users of historical analysis data sets can determine potential deficiencies. Chronology covers the entire data set archived during the production life of the 3DNEPH model, which was replaced on 1 August 1983 by the Real Time Cloud Analysis (RTNEPH) model. *Distribution authorized to the Department of Defense and DoD contractors only, critical technology, 11 June 1984. Other requests shall be referred to Hq Space Division/YDA, P.O. Box 92960, Worldway Postal Center, Los Angeles, CA 90009.*

4.3 1WW FORECASTER MEMOS. The 1st Weather Wing no longer exists. However, the AFWTL has copies of the following forecaster memos. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

1WW/FM-80-1 *Vertical Motion and Weather*, by Lt. Col. John H. Wylie, Jr., January 1980, 3pp.

1WW/FM-80-2 *Interpretation and Use of the AXAS and FXAS 12, 24, 36 KGWC*, by CMSgt. Thomas E. White, February 1980, 75pp.

1WW/FM-80-3 *Cut-Off Low Affecting the Republic of Korea*, by CMSgt. Thomas E. White, March 1980, 41pp.

1WW/FM-80-5 *The Case Study*, by CMSgt. Thomas E. White, December 1980, 2pp.

1WW/FM-81/001 *Uses, Strengths, and Weaknesses of the More Commonly Used Facsimile Products Received on the PACDIGS in Korea*, by CMSgt. Thomas E. White, November 1981, 7pp.

1WW/FM-81/002 *Station Forecaster Meeting*, by Capt. Kenneth M. Dropco, November 1981, 6pp.

1WW/FM-81/003 *Assessing Tropical Cyclone Development Potential Using Visual Satellite Imagery*, by Maj. David C. Danielson, 15pp.

1WW/FM-81/004 *Gridding Images from Polar-Orbiting Meteorological Satellites*, 16pp.

1WW/FM-82/001 *Suggested Guidelines for Certification and Follow-On Training Programs*, by Capt. Kenneth M. Dropco, 11pp.

1WW/FM-82/002 *METSAT Imagery Interpretation Test*, by Maj. Gordon R. Hammond, 28 December 1982, 13pp.

1WW/FM-83/001 *Techniques for Forecast Improvements*, by Capt. Kenneth M. Dropco, 31 March 1983, 5pp.

1WW/FM-85/001 *Forecasting Techniques for Bradshaw Army Airfield, Hawaii*, by TSgt. Duane C. Parker and SSgt. Billy R. Kitchen, 31 March 1985, 26pp.

1WW/FM-85/002 *Microbursts*, by SMSgt. Roy G. Metcalf, June 1985, 17pp.

1WW/FM-85/003 *Technical Management Guide for Station Chiefs—Volume 1, Master Training Program*, by SMSgt. Roy G. Metcalf, June 1985, 12pp.

1WW/FM-86/001 *METSAT Imagery Interpretation Test for the Pacific Theater*, by 1st Lt. Timothy F. Alsrue and Capt. David S. Hadley, August 1986, 24pp. Designed to complement initial Pacific theater METSAT certification programs.

1WW/FM-87/001 *Tornadic Activity in Korea: A Case Study*, by SSgt. Gordon H. Fesenger, Det. 10, 30th WS, January 1987.

1WW/FM-87/002 *Typhoon Briefing*, by Capt. Richard W. Hartman, August 1987. A briefing on central and western Pacific cyclone activity from June to November. IN COLOR—can be converted to briefing package.

1WW/FM-88/001 *Forecasting Hints for Japan*, edited by Capt. Timothy F. Alsrue, February 1988, 73pp. Forecasting hints and rules of thumb for Japan, most from "Rules of Thumb for Japan," published around 1966 by the Fuchu Weather Central.

1WW/FM-88/002 *Weather Patterns of the Big Island of Hawaii*, by MSgt. Franklin D. Cole and Maj. Rickard C. Savage, October 1988, 29pp. An update of 1WW/FM-85/001, but one that covers the entire island of Hawaii.

1WW/FM-88/003 *Forecasting Hints for Korea*, by Y. P. Yee, ROK Meteorologist, December 1988, 39pp. A compendium of forecasting hints from 20th WS and 30th WS.

1WW/FM-89/001 *Tropical Cyclone Climatology, Western Pacific*, by Capt. Frank Sornatale, July 1989, 61pp. A consolidated climatological planning document that draws statistics from the JTWC, NEPRF, and USAFETAC, OL-A.

1WW/FM-89/002 *NEXRAD—100 Years of Radar Evolution*, by Capt. Frank Sornatale, July 1989, 18pp. Describes the evolution of radar meteorology from WWII to the WSR-88D.

1st Weather Wing Forecaster Memos

Chapter 4

1WW/FM-89/003 *Streamline-Isotach Analysis*, by MSgt. Lee R. Bruce, July 1989, 20pp. Provides the "best of the basics" on the subject, collected from books, journals, and Chanute training guides.

1WW/FM-90/001 *El Nino and the Southern Oscillation*, by Capt. Frank Sornatale, May 1990, 15pp. Describes three major meteorological phenomena known as the "southern oscillation," the "El Nino," and the "Walker Circulation."

1WW/FM-90/002 *Alaskan Forecasting Techniques*, by Lt. Col. Anton Prechtel, Maj. Judson Stailey, Craig Egeland, and SSgt. Ronald Hoover, July 1990, 21pp. Describes some of the more promising forecasting techniques/rules-of-thumb developed by 11th WS personnel.

1WW/FM-90/003 *Electrooptical (EO) Tactical Decision Aid (TDA) Training Guide*, by Capt. Frank Sornatale, August 1990, 103pp. Designed to help units develop or enhance their electrooptical weather support.

1WW/FM-200 SERIES. Climate and Weather Regimes of... These FMs contain data extracted and copied from National Intelligence Surveys and AWS climatic briefs. They are marked "For official use only."

1WW/FM-200/001 *Climate and Weather Regimes of Korea*, December 1980.

1WW/FM-200/004 *Climate and Weather Regimes of Indonesia*, December 1980.

1WW/FM-200/002 *Climate and Weather Regimes of Japan*, December 1980.

1WW/FM-200/005 *Climate and Weather Regimes of New Zealand*, September 1981.

1WW/FM-200/003 *Climate and Weather Regimes of the Philippines*, December 1980.

1WW/FM-200/006 *Climate and Weather Regimes of Australia*, September 1981.

1WW/FM-300 SERIES. Briefing Climatologies. These FMs provide a brief climatological description of the location specified, along with a set of briefing slide masters. For the most part, they were prepared from terminal forecast reference notebooks and AWS climatic briefs.

1WW/FM-300/001 *Briefing Climatology for Clark AB, Philippines*, by Capt. Mike Kapel, September 1990.

1WW/FM-300/005 *Briefing Climatology for Kunsan AB, Korea*, by Capt. Mike Kapel and Capt. Paul MacArthur, July 1991.

1WW/FM-300/002 *Briefing Climatology for Yokota AB, Japan*, by Capt. Mike Kapel, August 1990.

1WW/FM-300/006 *Briefing Climatology for Kadena AB, Japan*, by Capt. Paul MacArthur, August 1991.

1WW/FM-300/003 *Briefing Climatology for Camp Casey, Korea*, by Capt. Mike Kapel, December 1990.

1WW/FM-300/007 *Briefing Climatology for Camp Humphreys, Korea*, by Capt. Paul MacArthur, September 1991.

1WW/FM-300/004 *Briefing Climatology for Osan AB, Korea*, by Capt. Mike Kapel, December 1990.

4-4. **2WW FORECASTER MEMOS.** The 2nd Weather Wing no longer exists. However, the AFW Technical Library (AFWTL) has copies of the following forecaster memos. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

2WW/FM-81/001 *Decoding British Met Office Analysis and Forecast Bulletins*, January 1981.

2WW/FM-81/003 Rescinded.

2WW/FM-81/004 Rescinded.

2WW/FM-81/005 Rescinded; contents incorporated in 2WW/TN-86/002.

2WW/FM-83/001 Rescinded.

2WW/FM-83/002 *PAVE TACK Electrooptical Orientation Course*, by Capt. Richard St. Pierre, August 1983. The handouts and reproducible slides of the EO course presented at Det 3, 28th WS, which participated in a test of EO forecasting support for the PAVE TACK forward-looking infrared (FLIR) sensor. *Distribution limited to U.S. Government agencies only, official/operational use, 25 August 1983. Refer requests to USAFE/DOW. WARNING: Subject to export control laws. This document contains information for manufacturing or using munitions of war. Export of the info contained herein, or release to foreign nationals within the U.S., without first obtaining an export license, is a violation of the International Traffic-in-Arms Regulation. Violation of this export law is subject to severe criminal penalties. Disseminate in accordance with provisions of DoD Directive 5230.25.*

2WW/FM-83/003 Superseded by 2WW/FM-88/001.

2WW/FM-84/001 Rescinded.

2WW/FM-84/002 Superseded by 2WW/FM-88/004.

2WW/FM-85/001 Superseded by 2WW/FM-88/001.

2WW/FM-85/002 *Technical Training—A Management Guide, USAFE/DOW*, October 1985, 9pp. Designed to help managers and supervisors administer technical training by tying requirements together in one package.

2WW/FM-86/001 *Terminal Forecast Reference Notebooks*, by SMSgt. Danny G. McGrew, May 1986, 68pp. Tells how to build and maintain a TFRN. Many examples.

2WW/FM-86/002 *Indigenous Products*, by SMSgt. Danny G. McGrew, May 1986. A brief discussion of selected indigenous meteorological products available in the European theater.

2WW/FM-86/003 *Forecast Reviews*, by Capt. Francis G. Tower and Capt. David W. Rust, and SMSgt. Danny G. McGrew, August 1986, 8pp. Guides forecasters and managers through the forecast review process in an attempt to relieve the "perceived threat."

2WW/FM-86/004 *Forecasting Techniques*, by SMSgt. Danny G. McGrew, October 1986, 22pp. A discussion of some general principles of meteorology applied in the forecasting process, and some techniques for improving forecasting skills.

2WW/FM-86/005 *Technical Management*, by SMSgt. Danny G. McGrew, October 1986, 11pp.

2WW/FM-86/006 *Managing the Detachment Technical Library*, by SMSgt. Danny G. McGrew, October 1986, 8pp.

2WW/FM-86/007 *Unit Seminar Programs*, by SMSgt. Danny G. McGrew and Sgt. Francis G. Tower, November 1986, 10pp.

2WW/FM-86/008 *An Initial Z-100 Training Guide for 2WW Units*, by Lt. Col. Donald L. Best, Maj John E. Fletcher, and Sgt. Francis G. Tower, December 1986, 13pp. Provides common information necessary to operate a unit's small computer.

2WW/FM-86/009 *The Local Analysis and Forecast Program (LAFP)*, by SMSgt. Danny G. McGrew, December 1986, 64pp. Provides guidance and examples for how to establish and use an LAFP.

2WW/FM-87/001 Superseded by 89/004.

2nd Weather Wing Forecaster Memos

Chapter 4

2WW/FM-88/001 Summary of 2WW Forecaster Hints, 1977-1987, compiled by MSgt. Thomas D. Avery, January 1988, 64pp. A compilation of selected 2WW forecaster hints transmitted over the AWN since 1977. Although the entire USAFE/DOW Staff has contributed to these "hints," the main author for the past 9 years has been Herr Harald Strauss, 2WW's Climatologist.

2WW/FM-88/002 PAVE TACK Electrooptical Training Mission Value Analysis, by Lt. Col. Donald L. Best and Maj Malcolm M. Gosdin, March 1988, 29pp. A value analysis of the Pave Tack EO training mission of the 48TFW, RAF Lakenheath, UK, with support services provided by Det 3, 28th WS. *Distribution authorized to U.S. Government agencies only, operational use, 15 March 1988. Other requests for this document shall be referred to USAFE/DOW.*

2WW/FM-88/003 Probability of Lightning Conditions, by Anja L. Carr, May 1988, 13pp. Explains, in readable and nontechnical terms, what "POLC" (Probability of Lightning Conditions) is, how it's derived, and what it means to aircrews, the target readership.

2WW/FM-88/004 METSAT Program Guidance, by Capt. Jeffrey E. Malan, April 1988, 11pp. Provides information needed to establish or maintain a unit METSAT data acquisition and application program.

2WW/FM-88/005 Catalog of 2WW Field Library Materials, by Anja L. Carr, May 1988, 177pp. A catalog of research materials on file at the 2WW Field Library, Kapaun Air Station, Germany.

2WW/FM-88/006 Forecasting Ceilings and Visibilities in the Eifel/Hunsrueck Area of Germany, by Herr Harald Strauss, April 1988, 33pp. This study was developed for a briefing during a 17-18 March 1988 joint USAFE/DOW-31WS/DN technical consultant visit to Spangdahlem AB. It is intended to familiarize new forecasters with the central European (especially Eifel) regime of "normal" winter weather.

2WW/FM-88/007 Glossary of German and English Meteorological Terms, by Anja L. Carr and Herr Harald Strauss, April 1988, 50pp. Provides short German-to-English translations of words, phrases, and abbreviations common to meteorology. Designed to assist those who

do not read German in translating weather bulletins and other technical materials.

2WW/FM-88/008 Glossary of English and German Meteorological Terms, by Anja L. Carr and Herr Harald Strauss, October 1988, 46pp. Provides short English-to-German translations of words, phrases, and abbreviations common to meteorology. Designed to assist those who do not read German in translating weather bulletins and other technical materials.

2WW/FM-89/001 Forecasting Black Ice in Western and Central Europe, By Herr Harald Strauss, March 1989, 9pp. Provides meteorological conditions favorable for formation of "black ice." Based on personal experience of the author in the Eifel-Hunsrück area of Germany. Applies to Germany, eastern Belgium, and possibly the Cotswold Hills region of the western UK.

2WW/FM-89/002 Forecasting Tips from the Aerospace Sciences Division, compiled by Anja L. Carr, April 1989, 18pp. European forecasting tips from sources throughout 2WW—not the same as USAFE/DOW hints transmitted on EURMEDS.

2WW/FM-89/003 Single-Station Analysis and Forecasting in Europe: Orientation for Unit Trainers, by Lt. Col. Donald L. Best, May 1989, 33pp. Supplements 2WW single station analysis and forecasting video, SAVPIN 608367.

2WW/FM-89/004 Climatological Summaries: Kaiserslautern Military Community, by Capt. Catherine M. Biddulph, May 1989, 14pp. Inspired by Ann Besson, a reporter for the Kaiserslautern American, a newspaper that uses these summaries in a monthly "Weather Watch" column. Statistics used are from standard AFCCC data for Ramstein and Sembach ABs, supplemented with information from a calendar of European weather "singularities," i.e., a weather condition that occurs around a specific date more often than would be expected due to chance.

2WW/FM-89/005 United Kingdom Meteorological Office Products, by TSgt. Carl J. Loerbs, September 1989, 49pp. Describes the history and function of the United Kingdom Meteorological Office (UKMO). Discusses UKMO products and tells how to use them.

2WW/FM-90/001 *The Sudden Appearance of Cloudiness over the Eifel-Hunsrück-Rheinpfalz Area under a Wintertime Ridge*, by Herr Harald Strauss, January 1990, 30pp. On 5 December 1989, unforecasted low clouds suddenly appeared over the Eifel-Hunsrück-Rheinpfalz area. This FM discusses what happened and why—and how to forecast similar events better in the future.

2WW/FM-90/002 *Recommended Technical Publications for 2nd Weather Wing Units*, by Maj. Carl J. Loerbs, March 1990, 16pp. A list of technical publications deemed most applicable to the European theater.

2WW/FM-90/003 *Preparing 2WW Technical Documents for Publication*, by Anja L. Carr, April 1990, 15pp. Provides guidance to those who prepare technical papers for publication within 2WW.

2WW/FM-90/004 *STIFAX Products*, by Capt. Caroline M. Reed (revised by Maj. Edward L. Weninger), August 1990, 57pp. Provides a description of products available on the STRIFAX circuit, along with a transmission schedule and selected examples. STRIFAX is a dedicated telefax network originating in

the RAF Strike Command Meteorological Office at High Wycombe.

2WW/FM-90/005 *Climate Tables for Arabia*, by K. Grant, UKMO, Bracknell, September 1990, 60pp. Prepared for RAF and other defense use in the Middle East; reprinted with permission.

2WW/FM-91/001 *Weather and Climate of Jordan*, by Herr Harald Strauss, January 1991, 36pp. A year-round guide to the weather and climate of Jordan, along with some forecasting hints.

2WW/FM-91/002 *The Unit T.H.E. (Technical Health Emphasis) Program Reference*, by MSgt. Michael A. Moore, May 1991, 29pp. Tells how to use the 2WW T.H.E. program. Includes 2WW philosophy on technical health evaluation, program indicator selection, and data interpretation. Also includes users manual for the T.H.E. output program and a set of ENABLE-based spreadsheets used to store and display T.H.E. data.

2WW/FM-91/003 *Tuning Your LAFP (Local Analysis and Forecast Program)*, by Capt. Paul G. LaPointe, June 1991, 39pp. Describes the techniques that are basic to a European base weather station's meteorological watch process.

4-5. 3WW FORECASTER MEMOS. The 3rd Weather Wing no longer exists; however, the AFWTL has copies of the following documents. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

3WW/FM-80/001 *Summary of Rules for Winter Precipitation Forecasting*, 18 January 1980, 3pp.

3WW/FM-80/002 *Drizzle*, 21 January 1980, 3pp.

3WW/FM-80/003 *Freezing Precipitation*, 23 January 1980, 13pp.

3WW/FM-80/004 *Snowshower Forecasting*, by Maj. Arthur T. Safford III, 30 January 1980, 4pp.

3WW/FM-80/005 *Atmospheric Electricity*, by Daniel R. Gornell, 4 March 1980, 9pp.

3WW/FM-80/006 *Spring Patterns*, 10 March 1980, 7 pp.

3WW/FM-80/007 Rescinded.

3WW/FM-80/008 *Summer Patterns*, by CMSgt. Eugene M. Weber, 3 September, 29 April 1980, 15pp.

3WW/FM-80/009 *Mesoscale Surface Analysis of the 10 April 1979 Tornadoes in Texas and Oklahoma*, by Allan R. Moller, 20 May 1980, 9pp.

3WW/FM-80/010 *Autumn Patterns*, by CMSgt. Eugene M. Weber, 3 September 1980, 17 pp.

3WW/FM-80/011 *Winter Patterns*, by CMSgt. Eugene M. Weber, 15 December 1980, 26 pp.

3WW/FM-81/001 *Spring Patterns*, by CMSgt. Eugene M. Weber, 12 March 1981, 23pp.

3WW/FM-81/002 *Categorical Forecasting Techniques Using the FOUS 60-78 LFM Teletype Output*, by TSgt. Frederick E. Gesser, 15 October 1981, 5pp.

3WW/FM-82/001 *Forecasting Severe Thunderstorms*, by Maj. Henry A. King III, 1 April 1982, 12pp.

3WW/FM-82/002 Superseded by 3WW/FM-90/001.

3WW/FM-82/003 *Summer Patterns*, Strategic Training

Range Complex (STRC), by CMSgt. Eugene M. Weber, 28 June 1982, 21pp.

3WW/FM-82/004 *Autumn Patterns*, STRC, by CMSgt. Eugene M. Weber, 3 September 1982, 15pp.

3WW/FM-82/005 *Winter Patterns*, STRC, by CMSgt. Eugene M. Weber, 12 November 1982, 35pp.

3WW/FM-82/006 *Caribbean Weather Familiarity Training*, by MSgt. Frederick E. Gesser, November 1982, 53pp.

3WW/FM-83/001 *Centralized Product Strengths and Weaknesses*, by Maj. James C. St John, 1 March 1983, 4pp.

3WW/FM-83/002 *Spring Patterns, STRC*, by CMSgt. Eugene M. Weber, 30 March 1983, 23pp.

3WW/FM-83/003 *Initializing the LFM, A Case of Good Agreement*, by Michael Schwilters, 5 April 1983, 2pp.

3WW/FM-83/004 *Use of GOES Data as an Aid in Short Range Stratus Forecasting*, by MSgt. John M. Hahn, 1 September 1983, 5pp.

3WW/FM-90/001 *METSAT Competency Check*, by Bill Swanson, 33pp. Designed to complement METSAT training programs by emphasizing interpretive skills. Includes review discussion, review questions, references.

3WW/FM-90/002 *Convective Techniques (A Springtime Primer)*, by Bill Swanson, 16pp. A look at new severe weather forecasting techniques and a review of some old ones.

3WW/FM-90/003 *Dynamics and Forecasting*, by Maj. Mike E. DesRosiers, updated, 9pp.

3WW/FM-90/004 *Unique Aircraft Icing Event (A Case Study)*, by Capt. Jeffrey L. Peters, updated, 13pp.

4-6. 4WW Forecaster Memos. The 4th Weather Wing no longer exists; however, the AFWTL has copies of the following documents. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

4WW TM 70-2 (AD-None) Relationship Between 10 CM Solar Flux and Sunspot Number, by MSgt. Terrell S. Birch, July 1970, 8pp. Because final values of the Zurich running average sunspot number (RASSN) are not available for several months, a more timely means of obtaining a value for RASSN is needed. The Ottawa 10 cm flux (F_{10}) is available daily and 27 day predictions are made by the Aerospace Environmental Support Center on a routine basis. A good relationship between RASSN and F_{10} could improve the ESSA foF2 and M(3000) predictions by using F_{10} to specify or predict RASSN. Monthly means of F_{10} were smoothed to arrive at 12 month running averages from December 1957 through May 1969. These were correlated with RASSN for the same period with excellent results. An equation for conversion of F_{10} to RASSN was then derived.

4WW TM 70-3 (AD-709888) Ionospheric Electron Density Profile Model, by Thomas D. Damon and Franklin R. Hartranft, July 1970, 41pp. Describes a 4WW project to produce a realistic electron density profile based on elements that can be forecast with reasonable accuracy. The model presented here consists of the sum of three Chapman layers (E, F1, F2). Electron densities in the topside ionosphere are controlled by complex motions rather than a production-loss balance and cannot be successfully described strictly by a Chapman layer. After some experimentation, a best fit was obtained by simply using the Chapman evaluation for the topside ionosphere, but computing the electron densities by using a variable scale height throughout the region. The interim program was used routinely for 8 months to predict profiles for radar refraction.

4WW TM 70-4 (AD-None) Relationship Between SPA and X-Ray Bursts, by Maj. Thomas D. Damon and TSgt. Donald C. Anderson, July 1970, 8pp. The relationship between the phase advance on VLF transmissions monitored at Manila Observatory and X-ray flux observed by Vela and Explorer satellites is investigated. A linear regression equation is derived.

4WW TM 71-1 (AD-8813426) Geomagnetic Disturbances, by 1st Lt. Bernard A. Walter, Jr., March 1971, 19pp. This paper describes the various phases of

a geomagnetic storm and the processes taking place in each phase. Also included is a review of the recent literature on various topics such as three-dimensional current system theories, satellite measurements of ring current particles, ground base magnetometer measurements and the relationship of ring current enhancements to auroral zone activity. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det 1, 4th Weather Wing, Air Force Base, Colorado 80912.*

4WW TM 71-2 (AD-None) Atmospheric Density Variations in the Region from 280 km to 500 km and Neutron Monitor Response, by MSgt. Edward D. Beard, R. F. Morris, April 1971, 9pp. A striking correlation appeared when variations in atmospheric density were compared to variations in Deep River neutron monitor counting rates. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det. 1, 4th Weather Wing, Air Force Base, CO 80912.*

4WW TM 71-3 (AD-None) The Relationship of 10 cm Flux to Sunspot Number, by MSgt. Terrell S. Birch, and Lt Col Kenneth E. German, April 1971, 10pp. Several equations relating 10 cm flux to sunspot number were evaluated, and a set of equations is proposed for AESC use. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det 1, 4th Weather Wing, Air Force Base, Colorado 80912.*

4WW TM 71-4 (AD-None) Flare Associated Geomagnetic Disturbances, by MSgt. Terrell S. Birch, and Lt. Col. Kenneth E. German, April 1971, 7pp. The ratios of power at various frequencies during solar radio bursts were designated to test the usefulness of a forecasting scheme proposal by Hakura in 1958. Hakura's proposal was validated, but the correlations are not high enough to represent significant improvement over presently used techniques. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det. 1, 4th Weather Wing, Air Force Base, CO 80912.*

4WW TM 71-5 (AD-None) *On the Relationship of Standard MUF with MOF*, by MSgt. W. S. Kuster, Jr., April 1971, 23pp. Deviations of standard MUF from monthly mean values for several vertical incidence ionosonde sites in Japan were compared with deviations of MOF from monthly mean values for several obliquely sounded high frequency paths. The results show that there is good correlation only part of the time. These conditions are identified, and some of the noncorrelated periods are discussed in terms of application to forecasting deviations of the oblique MUF from observed deviations of the standard MUF. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det 1, 4th Weather Wing, Air Force Base, CO 80912.*

4WW TM 71-7 (AD-None) *Variation of HF Radio Propagation Conditions with the Solar Cycle*, by A1C R. H. Gertken, MSgt. Terrel S. Birch, and Lt Col Kenneth E. German, June 1971, 51pp. Long distance High Frequency (HF) radio communications are expected to be worse during solar minimum than during maximum. The ionosphere, upon which HF (3-30 MHz) radio wave propagation depends, varies in mean electron density as a function of the mean variations in solar electromagnetic and corpuscular flux density throughout the 11-year solar cycle. During solar maximum, the ionosphere can be expected to support HF radio wave propagation nearly 100 percent of the time, despite interruptions of two to three percent caused by Sudden Ionospheric Disturbances (SIDs) and ionospheric storms. The greatly reduced incidence of SIDs and ionospheric storms during solar minimum accounts for communication interruptions of only 0.1 to 0.3 percent. Nevertheless, propagation conditions can be worse during solar minimum because the reduced ionizing solar radiation results in a reduced average range of propagating frequencies (propagation window). A further limiting factor during solar minimum can be the occurrence of the propagation window at the more heavily used lower frequencies. During solar minimum, the day to day variations of the ionosphere are expected to have a greater effect upon propagation conditions than during solar maximum. As a result HF communications during solar minimum will suffer more degradation and be less reliable than during solar maximum. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det 1, 4th Weather Wing, Air Force Base, Colorado 80912.*

4WW TM 71-8 (AD-None) *MUF/LUF Forecast Verification*, by Kenneth E. German, July 1971, 54pp. The Aerospace Environmental Support Center (AESC) has been forecasting maximum usable frequency (MUF) and lowest usable frequency (LUF) for high frequency (HF) radio communications paths for nearly three years. Oblique soundings were made routinely over some of the paths. For each ionogram maximum observed frequency (MOF) and lowest observed frequency (LOF) were scaled and provided to the AESC. As a result, a large data sample was collected. A forecast verification program has existed for some time, and the results are presented herein in terms of average percent error as a function of time and path. Geomagnetically quiet and disturbed days were compared. Overall, the AESC forecasts were better than the monthly or semimonthly forecast medians, and were comparable to some oblique sounder frequency management techniques. As expected, the AESC (MUF) forecasts during geomagnetically disturbed conditions represented the greatest improvements over monthly media and oblique sounder techniques than during geomagnetically quiet conditions. *Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det. 1, 4th Weather Wing, Air Force Base, CO 80912.*

4WW TM 71-10 (AD-737355) *An Operational Approach to Forecasting Polar Cap Absorption (PCA) Events*, by SMSgt. J. Krause, December 1971, 57pp. The Aerospace Environmental Support Center (AESC) of the USAF Air Weather Service provides military and civilian agencies with information and forecasts related to the atmospheric and space environments. One aspect of the AESC's support involves the effect of solar proton events upon transpolar high frequency (HF) radio propagation. This study addresses the problem of predicting the occurrence of Polar Cap Absorption (PCA) events resulting from solar proton enhancements near earth. Various aspects of the energetic solar flare event are reviewed and an attempt is made to assess their relative importance in arriving at a PCA forecast. Data pertinent to the flare event are considered in five general classes: radio burst data, x-ray burst data, optical data, solar region history, and the sector structure of the interplanetary magnetic field. An evaluation checklist is developed for use by the AESC forecaster. The checklist reflects the varying degrees of contributions of information in the five categories toward determining the "Total PCA Factor." *Each transmittal of this*

document to outside agencies of the U.S. Government must have prior approval of the commander, Det. 1, 4th Weather Wing, Air Force Base, CO 80912.

4WW TM 72-1 (AD-744883) *Morphology of a Solar-Terrestrial Event in Late September and Early October 1969*, by Maj. Clement J. Thomas, May 1972, 56pp. This report looks at the geomagnetic and ionospheric disturbances that were associated with solar flares on 25 and 27 September 1969. The terrestrial responses to these two solar events were considerably different. To better understand these differences, the events are related to some of the contemporary geophysical theories. The specific results of this study reinforce the general conclusion reached in previous ionospheric morphologies. The reason for the different F-region effects of these events appears to be dependent upon the pre-event magnetospheric conditions.

4WW TM 72-2 (AD-None) *Longevity of Active Solar Regions*, by CMSgt. Carl K. Clay, June 1972, 8pp. The results of a study performed to help provide some operational rules for the solar forecasters of the Aerospace Environmental Support Center (AESC).

4WW TM 72-3 (AD-745100) *Basic Neutral Line Patterns Defining Interplanetary Discontinuities*, by MSgt. Arnold U. Starr, June 1972, 7pp. This report briefly describes certain chromospheric patterns which appear to show significant correlation with changes in the interplanetary and geomagnetic fields.

4WW TM 72-4 (AD-None) *Geomagnetic Disturbance Prediction*, by MSgt. Arnold U. Starr, June 1972, 56pp. A primer for forecasting solar and global geomagnetic events.

4WW TM 72-5 (AD-None) *Solar Activity and Related Effects During the Period 1-12 August 1972*, by Lt. Col. Jack L. Buckingham, Maj. Clement J. Thomas, and MSgt. Edward D. Beard, August 1972, 40pp. A tremendous amount of interest was generated within the DoD concerning the unusually high level of solar activity

originating in AESU Region 331. This region produced a series of energetic solar events which occurred at a time when the solar activity cycle was on a declining trend. The impact of the solar-geophysical activity associated with this region on various DoD electronics systems has prompted the Aerospace Environmental Support Unit (AESU) to prepare this morphology of solar activity, including not only the effects, but also the support provided by and to the AESU in fulfilling its space environmental support mission. ***Each transmittal of this document to outside agencies of the U.S. Government must have prior approval of the commander, Det 1, 4th Weather Wing, Air Force Base, CO 80912.***

4WW TM 72-6 (AD-None) *U.S. Air Force Aerospace Environmental Support Center Role in Support to Radar Systems*, by Capt. Willis D. Kriese, November 1972, 34pp. This report presents an abbreviated overview of the Aerospace Environmental Support Center (AESC) and describes certain aspects of the AESC's Space Forecasting Branch (SFB). The AESC is a staff division of the 12th Weather Squadron, 3rd Weather Wing (Air Weather Service), and is located in the NORAD Cheyenne Mountain Complex (NMC), Colorado Springs, Colo. It is the centralized operational support agency for the U.S. Air Force Space Environmental Support System (SESS). The mission of the Space Forecasting Branch includes the responsibility of collecting, analyzing, reporting, and predicting solar-geophysical activity which may have a direct impact on the effectiveness of military operations. Environmental support to radar systems is a major role for the SFB, particularly the support to long-range and over-the-horizon radars. Due to ionospheric retardation and refraction of UHF and VHF, satellite tracking radars encounter errors in range and azimuth. Realistic ionospheric electron density profiles permit operators of long-range radar systems to apply corrections for the errors.

4-7. 5WW FORECASTER MEMOS. The 5th Weather Wing no longer exists; however, the AFWTL has copies of the following documents. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

5WW/FM-79/001 *Fog and Stratus*, by Maj. Michael G. Olivier (edited by Capt. Dale L. Johnson), July 1979, 8pp.

5WW/FM-80/001 Superseded by 5WW/FM-86/005.

5WW/FM-80/002 Superseded by 5WW/FM-86/005.

5WW/FM-80/003 Rescinded.

5WW/FM-80/004 Rescinded.

5WW/FM-81/001 *An Example of Local Analysis and Forecast Program (LAFP)*, by SMSgt. Earl W. Rook (FM preparation by Capt. Gary L. Sickler), February 1981, 12pp.

5WW/FM-81/002 *Shortcut for Moonrise and Moonset Calculations*, by Maj. Dale L. Johnson and TSgt Gerald L. Wheeler, February 1981, 5pp.

5WW/FM-81/003 Rescinded.

5WW/FM-81/004 *Topical Breakout of Teletype Bulletins Useful in Forecast Preparation*, by Capt. Timothy D. Crum, April 1981, 18pp. Simplifies and expedites the forecaster's task of finding additional guidance to aid in a CONUS forecast decision-making process.

5WW/FM-81/005 *The Damming Effect of the Southern Appalachians*, by Barry A. Richwien (FM preparation by Capt. Steven A. Taylor), April 1981, 12pp.

5WW/FM-81/006 Rescinded.

5WW/FM-82/001 *Fundamental Forecast Concepts for Northeast Africa and the Saudi Arabian Peninsula for the period of November/December*, March 1982, 10pp.

5WW/FM-82/002 *Identifying Severe Local Storms Operationally - An Analysis on Radar Technique*, by Ron W. Przblynski (FM preparation by Capt. Edwin S. Arrance), April 1982, 7pp.

5WW/FM-82/003 *Examples of a Wide Variety of Thunderstorm Propagation Mechanisms*, by Raymond

M. Zehr and James F. W. Purdom (FM preparation by Capt. Edwin S. Arrance), April 1982, 7pp.

5WW/FM-82/004 *Nowcasting During the 10 April 1979 Tornado Outbreak: A Satellite Perspective*, by James F.W. Purdom and John F. Weaver (FM preparation by Capt. Edwin S. Arrance), April 1982, 11pp.

5WW/FM-82/005 *Observations and Insights Forecasting at Cairo West and Southwest Asia in Nov-Dec*, by Capt. Timothy D. Crum and Capt. Gary L. Sickler, 31pp.

5WW/FM-82/006 *An Example of Jet Stream Configurations, 500 mb Vorticity Advection and Low-Level Thermal Advection Patterns During Extended Periods of Intense Convection*, by Robert A. Maddox and Charles A. Doswell III (FM preparation by Capt. Edwin S. Arrance), June 1982, 16pp.

5WW/FM-83/001 Rescinded.

5WW/FM-83/002 *Lightning and Aircraft*, by Lt. Col. J. Allen Zak, October 1983, 8pp.

5WW/FM-84/001 *Technical Training Program*, by Maj. Richard G. Peer, September 1984, 4pp. Describes a technique that permits calculation of times of sunrise/set, moonrise/set and the twilights.

5WW/FM-84/002 *Southwest Asia Weather Familiarity Training, Winter (December-March)*, by Maj. Richard G. Peer, September 1984, 57pp.

5WW/FM-85/001 *Honduras Annual Climatology*, by MSgt. George T. Gilligan Jr., April 1985, 12pp. Gives forecasters a summary of climatological data available for Honduras. List of sources provided.

5WW/FM-86/001 *Base Weather Station Quality Control Program*, by Lt. Col. Stephen J. Savage, February 1986, 24pp. Discusses 5WW philosophy on the base weather station quality control program and provides suggested program formats.

5WW/FM-86/002 *Central America Weather Familiarity Training*, 5WW/DO, April 1986, 45pp.

Provides dataset for use in mobility training programs (weather observations and forecasts 0000-1200Z, 26-28 February 1986—also example surface streamline analyses).

5WW/FM-86/003 *Weather Staff Officers Guide to Climatology*, by Lt. Col. Kenneth W. Hertzler, July 1986, 17pp. Shows weather staff officers how to use climatology in their staff duties. First section covers concepts and procedures for applying climatology to planning. Second section identifies climatological resources and shows how to organize and use them. Appendix gives additional uses for climatology. *Distribution authorized to U.S. Government agencies and their contractors, administrative or operational use, July 1986. Other requests for this document shall be referred to 5WW/DNC.*

5WW/FM-86/004 *Turbulence Forecasting*, by C.L. Chandler, Manager of Weather, Delta Airlines, August 1986, 24pp. This article, reprinted with permission, is based on knowledge acquired from thousands of hours of observations during 39 years of night by Delta.

5WW/FM-86/005 *Preparing a Forecast Using Centrally Produced Facsimile Products*, by Capt. Jeannette M. Baker, USAFR, August 1986, 6pp. Gives a carefully structured procedure for analyzing and using facsimile products to produce a better forecast.

5WW/FM-86/006 *A Guide for Using Upslope and Lee Effect Charts*, by TSgt. Kenneth R. Chesson, September 1986, 5pp. Gives guidance on use of Upslope and Lee Effect Charts provided by Amt Für Wehrgeophysik (GMGO). Reprints background sheet provided 2WW by GMGO. Designed for use with GNC-4 chart for Central Europe (available from DMAAC through base or airfield operations)—acetate overlay available From 5WW/DNC. *Distribution authorized to U.S. Government agencies and their contractors, foreign government information, September 1986. Other requests for this document shall be referred to 5WW/DNC.*

5WW/FM-86/007 *Dhahran, Saudi Arabia, Local Forecast Study*, edited by MSgt. George T. Gilligan, Jr., September 1986, 42pp. Essentially a rewrite of a post-World War II (1952) forecast study, but with up-to-date climatology.

5WW/FM-86/008 *Tips on Avoiding Low-Level Icing*, by retired USNR, Cmdr. Norman Shulyer, November 1986, 5pp. Reprinted with permission from January 1986 AERO Magazine. Should be of value to forecasters briefing aircrews planning low-level flight.

5WW/FM-87/001 *Use of the 500-mb Hemispheric Heights/Temperatures Chart*, by Maj. Richard G. Peer, May 1987, 9pp. Provides techniques for using 500-mb hemispheric analysis chart; these techniques supplement the 5WW "Back to Basics" program and provide an insight into atmospheric motion and dynamics. The 500-mb hemispheric chart can be used to assess computer model prognoses, aid in satellite interpretation, view the "big picture," and enhance mobility training. With two color plates.

5WW/FM-87/002 *The Summer Monsoon of the Southwestern United States*, by Lt. Col. Stephen J. Savage and Capt. Jeanette M. Baker, June 1987, 4pp. Identified and describes moisture sources and triggering mechanisms for the summer monsoon that occurs in the southwestern United States during June, July, and August.

5WW/FM-87/003 *Tropical Meteorology in the Western Hemisphere*, by Capt. Michael T. Gilford, June 1987, 42pp. For forecasters inexperienced in tropical meteorology. Examines tropical weather in western hemisphere, concentrating on Central America. Discusses seasonal changes, reviews synoptic and mesoscale features that affect day-to-day weather. Tropical analysis and forecasting techniques are discussed. Section on streamline analysis.

5WW/FM-87/004 *Quick Reference Guide for NMC Numerical Weather Prediction Models*, by 1st Lt. Donald H. Berchoff, June 1987, 28pp. A concise guide to four NWP bulletins produced by the NMC: NGM outputs, LFM outputs, model output statistics (MOS), and trajectory forecasts. Includes alpha directory of bulletin headers for major U.S., Canadian, and Alaskan stations. Bulletin breakdown (and brief discussion of use) is provided.

5WW/FM-87/005 *Surf Forecasting*, by Maj. Richard G. Peer, July 1987, 25pp. An introduction to forecasting surf conditions for amphibious assault operations. Although not intended to produce expert surf forecasters,

it provides the basic terminology and elements needed to familiarize those involved in joint assault operations with the problem.

5WW/FM-87/006 *Seasons in Review: GOES Satellite Photos Over Central America*, by Maj. Douglas C. Pearson, Capt. Michael Michel-Howell, Capt. Christopher S. Strager, and Capt. Charles H. Larcomb, August 1987, 81pp. AWS forecasters supporting the United States Southern Command from January 1985 to June 1987 viewed thousands of weather satellite photos and saved those that were most representative of central American weather. The photos shown here were selected from that collection. The authors provide a discussion of each photo and the situation it represents, along with an introduction and CFLOS data for three locations.

5WW/FM-87/007 *Weather Phenomena Associated with Appalachian Cold-Air Damming*, by Capt. David T. Miller, November 1987, 41pp. Complements 5WW/FM-81/005 in providing a detailed description of weather accompanying Appalachian cold-air damming. Discusses cold-air damming itself, then associated weather phenomena: the coastal front, "zipper" lows, warm front bending, and the "back door" cold front. Includes Forecasting guidelines.

5WW/FM-88/001 *Over-the-Horizon Backscatter Radar and Ionosphere Familiarization Training for Air Weather Service Personnel*, by Maj. Richard G. Peer, June 1988, 161pp. Provides basic information for weather forecasters interested in OTH-B radar, the ionosphere and its effects on OTH-B, and ionospheric-monitoring bulletins available from AFGWC and other agencies. OTH-B glossary and list of acronyms/abbreviations included. Errata provided in 5WW/DNS letter, 5 April 1989.

5WW/FM-88/002 *Guide for Developing a Technical Mobility Training Program*, by Maj. Richard G. Peer, July 1988, 12pp. Developed to assist units in developing and conducting sound unit technical mobility training programs for mobility augmentees.

5WW/FM-88/003 *Lightning Detection System Acquisition and Application*, by Capt. John D. Murphy, November 1988, 53pp. Discusses the numerous types or Lightning Detection Systems (LDSs) and Lightning Detection Networks (LDNs) currently in use; compares strengths and weaknesses, describes applications.

5WW/FM-88/004 *Winter Precipitation*, by Capt. John D. Murphy, November 1988, 115pp. Introduces weather forecasters to some rules-of-thumb for forecasting winter precipitation types and amounts. Includes "Heavy Snow Forecasting Exercise" presented at Winter Storm Forecasting Workshop conducted at Raleigh-Durham, NC (RDU) by National Weather Service on 26-30 September 1988.

5WW/FM-89/001 *Mesoscale Analysis and Forecasting*, by Capt. John D. Murphy, April 1989, 48pp. A compilation of mesoscale analyses (mesoanalyses) and forecasting techniques in use today. Revives 5WW/TN-71-5 and supplements AWS TR 200 (Rev).

5WW/FM-89/002 *Use of Weather Data Requirements Contingency Packages*, by Maj. Jeannette M. Baker, August 1989, 13pp. Assists units in setting up and using Weather Data Requirements Contingency Packages (WDRCPs). WDRCPs are used to meet unit mobility commitments by preparing Forecasters to use products available during deployments. Errata (page change) provided in 5WW/DNS letter, 13 November 1989.

5WW/FM-90/001 *Analysis of El Nino Events*, by Capt. Vicki A. Miller, May 1990, 12pp. Provides most current information on the El Nino phenomenon.

5WW/FM-90/002 *Staff Radar Training Program*, by Capt. Terry Given, September 1990, 12pp. Provides a radar training program for staff personnel involved in staff assistance visits and technical consultant visits.

5WW/FM-91/001 *Integrated Refractive Effects Prediction System (IREPS) Training Package*, by Capt. Terry Given, April 1991, 32pp. Provides guidance for establishing an IREPS support program.

4-8. 7WW FORECASTER MEMOS. The 7th Weather Wing no longer exists; however, the AFWTL has copies of the following documents. Order forecaster memos from the Air Force Weather Technical Library (AFWTL), 151 Patton Ave. Rm 120, Asheville NC 28801-5002 DSN 673-9019.

7WW/FM-77/002 Rescinded.

7WW/FM-77/004 *Wind Shear is Dangerous*, 15 December 1977, 2pp. Discusses types of wind shear and wind shear detection systems.

7WW/FM-78/001 *Low-Level Wind Shear (Reprints from TAC Attack)*, 15 February 1978, 16pp. A summary of wind shear as it affects aircraft operations.

7WW/FM-78/003 *Back to Basics*, 1 June 1978, 9pp. Stresses routine synoptic analyses and restates basic analysis rules and procedures.

7WW/FM-78/005 *Atmospheric Electricity*, 1 July 1978, 13pp. Discusses the impact of atmospheric electricity on aircraft and other weapon systems.

7WW/FM-78/006 Rescinded.

7WW/FM-78/008 *Radar Signatures and Severe Weather*, 1 September 1978, 8pp. Excerpts and conclusions from the thesis, "An Investigation of Radar Returns and their Relationship to Severe Weather Occurrences."

7WW/FM-78/009 *Limitations of FAA Radars in Storm Detection*, 1 September 1978, 3pp. Discusses limitations of ARTCC radar and compares its capabilities with those of the AN/FPS-77.

7WW/FM-78/010 Rescinded.

7WW/FM-78/011 *Flash Flood Forecasting*, 1 September 1978, 5pp. Reprint of NWS Eastern Region guide for recognition of flash flood potential.

7WW/FM-78/012 Rescinded.

7WW/FM-78/013 *Lightning Casualties*, 1 September 1978, 4pp. Summary of a study that reveals lightning is under-reported as a killer because of its erratic and sporadic nature.

7WW/FM-78/014 *SPOT Index - An Indicator of Severe Storm Potential*, 1 September 1978, 3pp.

Discusses a technique that uses the severe storm potential (SPOT) index to define areas of potential severe weather.

7WW/FM-78/015 *Use of Geostrophic Wind and Vorticity Bulletin (ASUS 10 KMKC) in the Local Analysis Program*, 1 September 1978, 9pp. Discusses use of this bulletin and streamline analysis to identify synoptic features.

7WW/FM-78/018 Rescinded.

7WW/FM-78/019 *Precipitable Water - Monthly Means*, 1 November 1978, 11pp. Summary of NOAA Technical Report NWS 20. Identifies observed precipitable water as parameter for weather forecasts. See 7 WW/FM-78/011.

7WW/FM-78/022 *Variation in Radar Echo Tops*, 1 December 1978, 1p. A summary of why heights of echo tops vary between reporting stations.

7WW/FM-78/023 *The Southwest Low and Henry's Rule*, 1 December 1978, 7pp. Discusses the two synoptic conditions that precede the eastward movement of the Southwest low.

7WW/FM-78/025 *Rain or Snow?*, 1 December 1978, 1p. Explains why sometimes snow occurs with temperatures at or above freezing.

7WW/FM-78/026 *Climatology of First Snowfall, Freezing Rain, and Blizzards*, 1 December 1978, 5pp. Discusses forecasting of winter precipitation based on climatology.

7WW/FM-79/001 *AWS Technical Library (AFWTL) Services*, 1 February 1979, 3pp. Discusses use of the AFWTL as the focal point for furnishing meteorological reference materials.

7WW/FM-79/003 *Freezing Precipitation*, 1 February 1979, 5pp. Discusses surface and upper-air parameters used for forecasting freezing precipitation.

7WW/FM-79/005 Rescinded.

7WW/FM-79/006 *Computation of Crosswinds from*

RUSSWO Data, 1 April 1979, 5pp. Describes a simple graphical technique for computing crosswind components.

7WW/FM-79/007 Low-Level Wind Shear, 1 May 1979, 17pp. Provides guidance for recognizing the meteorological situations that produce low-level wind shear.

7WW/FM-79/008 Fallout Winds, 1 May 1979, 5pp. Discusses NWS procedures for predicting fallout winds in the CONUS.

7WW/FM-79/009 Worldwide Climatology of Tropical Storms, 15 July 1979, 93pp. Source of climatological information on hurricanes and typhoons to satisfy local and contingency planning support needs.

7WW/FM-79/010 Acronyms Commonly Used in AWS, by SrA. Gale Crowley, 20 July 1979, 5pp. A convenient list of acronyms.

7WW/FM-79-011 Using Satellite Field Service Stations, 15 November 1979, 2pp. Discusses SFSS's role in GOES data service.

7WW/FM-80/002 Use of Satellite Derived Winds in Centralized Analysis, 30 October 1980, 4pp. Discusses use of satellite derived winds to fill in data sparse areas during model initialization.

7WW/FM-81/001 A Technique for Forecasting Heavy Precipitation in the Southeast United States, 5 February 1981, 5pp. Discusses the results of a study conducted by NWS and a technique for forecasting heavy precipitation.

7WW/FM-81/002 Weather Warning Support Index, 1 June 1981, 5pp. Describes the index, computational procedures, and specific uses as a management indicator.

7WW/FM-81/003 Wind Shear, 15 September 1981, 4pp. Explains wind shear to forecasters and aircrews.

7WW/FM-81/004 Reliability Studies, 15 September 1981, 4pp. Encourages forecasters to perform studies to determine product reliability and provides information on setting up such studies.

7WW/FM-81/005 Rescinded.

7WW/FM-82/001 Rescinded.

7WW/FM-82/002 Lightning Strikes to Aircraft, 15 March 1982, 7pp. Provides forecasters and customers information about the lightning/electrostatic discharge threat.

7WW/FM-82/003 Commonly Used Equations in Meteorology, 22 March 1982, 9pp. Introduces several reliability equations used in meteorology.

7WW/FM-82/004 Acronyms Commonly Used in AWS, 10 May 1982, 8pp. A convenient list of common acronyms.

7WW/FM-82/005 A Logical Approach to Preparing a Weather Forecast, 1 June 1982, 2pp. Lists weather parameters in an order of use that leads to a logical approach to preparing a weather forecast.

7WW/FM-82/006 Checklist for Forecaster Orientation, 26 July 1982, 6pp. A series of checklist to aid in the orientation of new forecasters.

7WW/FM-83/001 Lajes Crosswind Data, 1 February 1983, 55pp. Provides crosswind data to those units that support aircraft which transit Lajes Field, Azores.

7WW/FM-83/002 Rescinded.

7WW/FM-83/003 METSAT Training Outline "Recurring Training", 15 May 1983, 15pp. Provides units receiving GOES satellite imagery with sample training sections dealing with uses of satellite imagery.

7WW/FM-83/004 Use of METSAT Imagery, 15 June 1983, 4pp. Discusses METSAT imagery reference files (MIRF) and use of METSAT in LAFF, metwatch, and briefings.

7WW/FM-83/005 Tornado Climatology, 15 July 1983, 12pp. Summarizes the results of 29 years of tornado data, provides maps and graphs for tornado safety, and gives the total number of tornados in one degree squares for the period 1955-1967.

7WW/FM-83/006 Canyon Wind Episode of April 3-5, Hill AFB, UT, 30 September 1983, 20pp. Emphasizes how local rules of thumb and good analysis of a given situation can result in good forecast support to the customer.

7WW/FM-83/007 *Additional Techniques for Forecasting Freezing Precipitation*, 30 September 1983, 2pp. Reviews freezing precipitation processes and discusses a few objective forecasting techniques.

7WW/FM-83/008 *Forecasting Upslope Stratus and Fog in the Central Plains*, 18 November 1983, 7pp. Describes the synoptic patterns and climatology of upslope stratus and fog formation.

7WW/FM-83/009 Superseded by 7WW/FM-88/001.

7WW/FM-84/001 *Quality Control Program in the Base Weather Station*, 12 January 1984, 21pp. Articulates 7 WW philosophy concerning quality control programs in the base weather station.

7WW/FM-84/002 *Weather Warning Support Index*, 20 February 1984, 8pp. Discusses this index and its use as a management indicator in 7 WW.

7WW/FM-84/003 *Computer Flight Plan (CFP) Guide*, 15 March 1984, 44pp. Provides a source for interpreting computer flight plan printouts.

7WW/FM-84/004 *Technical Training Program*, 15 April 1984, 8pp. Designed to assist unit supervisory personnel in managing technical training requirements.

7WW/FM-84/005 *Korean Mobility Training Program*, 20 March 1984, 110pp. A mobility training package and outline for deployment training anywhere.

7WW/FM-84/006 *Use of GOES Data in Forecasting, and Analyzing the Southeast Colorado Low*, 1 May 1984, 20pp. Discusses repeatable meteorological signatures that might improve confidence in forecasting development of the "Colorado Low."

7WW/FM-84/007 *Severe Weather Case Study, Scott AFB, IL, on 3 April 1984*, 1 May 1984, 22pp. Summarizes the major features and clues that led to the early detection of a severe weather episode.

7WW/FM-84/008 Rescinded.

7WW/FM-84/009 *Forecasting Mesoscale Convective Complexes*, 29 June 1984, 17pp. Presents empirically designed forecast techniques from observations of life cycles of numerous MCCs.

7WW/FM-84/010 *Secondary Trough Triggers Severe Weather*, 15 December 1984, 20pp. Discusses how this severe weather system developed and highlights how radar, satellite, and conventional data must be used together to provide adequate leadtime.

7WW/FM-84/011 *Summer European Mobility Training Package*, 30 November 1984, 80pp. Provides mobility officers and NCOs a package of data for use in developing a training program.

7WW/FM-85/001 *Mobility Training Package—Turkey, Fall Season*, 15 March 1985, 73pp. Provides mobility officers and NCOs a dataset for use in the unit mobility training program.

7WW/FM-85/002 *Geography Quiz for Mobility*, 15 April 1985, 41pp. A quiz for mobility officers and NCOs to use in their local training program.

7WW/FM-86/001 *Plotting the LFM and NGM Teletype Output*, 1 April 1986, 7pp. Explains 3WW method for plotting LFM FOUS 60-78 teletype bulletins, as well as newer Nested Grid Model bulletins.

7WW/FM-86/002 *Baroclinic Leaf 6-8 November 1984—A Significant Weather Development*, by Maj. Brian E. Heckman, USAFR, April 1986, 17pp. The "baroclinic leaf" is a feature often observed in satellite imagery during cool seasons, but often missed by NWP models; sometimes associated with fast-developing surface cyclones and significant weather.

7WW/FM-87/001 *Checklist for Weather Augmentees to Safety Investigation Boards*, by Lt. Col. David C. Danielson and Capt. Craig R. Wilkes, 30 October 1987, 10pp.

7WW/FM-88/001 *Recurring Radar Training*, 15 April 1988, 14pp. Provides five tests (including answer sheets and keys) on radar principles, FPS-77/FPQ-21 operations, reporting procedures, and interpretation.

7WW/FM-88/002 Not used.

7WW/FM-88/003 Superseded by 7WW/FM-90/001.

7WW/FM-89/001 *Toxic Corridors*, by Lt. Col. David C. Danielson, Capt. Leslie A. Brenton, and SMSgt. Michael A. Jimenez, 1 July 1989, 26pp. Errata in 7WW/DNC letter, 6 October 1989 (new Page 17).

7WW/FM-89/002 USAFETAC Priority System, by Thomas Dorencamper, 30 July 1989, 2pp. Explains "Assignment of Priorities" (AWSR 105-18, Para 2-4).

7WW/FM-89/003 Forecaster Knowledge Quiz, by Capt. Craig R. Wilkes, September 1989. This FM can help forecasters find where they stand in technical proficiency by identifying and correcting—with a little refresher training—their own personal weaknesses.

7WW/FM-90/001 Seventh Weather Wing (7 WW) Health Plan, by Paul Quast and SMSgt. Michael Jimenez, February 1990, 8pp. Designed to monitor, evaluate, and improve the technical quality of the meteorological forecasts and products prepared at each 7WW forecasting unit. Supersedes 7WW/FM-88/003.

7WW/FM-90/002 Using Conditional Climatology, May 1990, 10pp. Provides a brief history and description of WSCC (wind stratified conditional climatology) and MODCV (modeled climatology ceiling and visibility). Tells how to use both. Includes examples.

7WW/FM-90/003 Terminal Forecast Reference Notebook, May 1990, 4pp. Tells how to organize and format unit TFRNs.

7WW/FM-90/004 Forecasting Techniques Notebook and Forecaster Aids Notebook, May 1990, 3pp. Describes the purpose, organization, and contents of both notebooks.

7WW/FM-90/005 Forecast Discussions, June 1990. Provides guidance for conducting forecast discussions—timing, participation, example outline.

7WW/FM-90/006 Technical Improvement Program, June 1990. Provides guidance on how to stay up to date technically—how to conduct forecasting studies, when to ask USAFETAC, etc.

7WW/FM-90/007 Operational Uses of Streamline Analyses, by SMSgt. Michael A. Jimenez, MSgt. Michael A. Moore, and SSgt. Michael R. Brenner, May 1990.

7WW/FM-91/001 Low-Level Wind Shear: Still Dangerous After All These Years, by SMSgt. Michael Jimenez, 23 May 1991. Introduces low-level wind shear (LLWS) to a new generation of AWS forecasters and reemphasizes its dangers to seasoned forecasters.

7WW/FM-91/002 Microbursts: A Primer, by retired SMSgt. Michael Jimenez, 15 July 1991. Consolidates information from different sources to serve as a "primer" on microbursts.

Catalog of Air Force Weather Technical Documents

Chapter 5

PROJECT REPORTS

5.1 AFCCC PROJECT REPORTS. Although AFCCC project reports have been produced since at least 1954 (and probably before that), few were actually published and/or registered with the Defense Technical Information Center (DTIC). Most project reports were only prepared in enough copies for the specific requestor, with the apparent thought that the research involved was specific to that project and to that project only. Because as all project reports, published or unpublished, normally apply to specific projects and time periods, readers should use caution in requesting and using a "project report" operationally. It is strongly recommended that potential users check with AFCCC before using data or drawing operational conclusions from any of the following documents. The listing represents all the reports found so far among the AFWTL's cataloged and uncataloged holdings. Note that DoD technical report numbering (IAW current standards) began in 1978. Before that, reports were numbered serially, apparently in the order in which projects were begun, rather than finished. In the future, documents that would have been issued as project reports will be issued as technical notes.

1862 *Weather Favorable for Aerial Photography, Parts A-Z*, 1953-59. Prepared for a number of countries and regions for Army Map Service; criteria required clear skies, no obstructions to vision, no snow cover, and a solar altitude of at least 30 degrees. Report based on observations of simultaneous occurrence of total cloud cover less than 1/10, visibility greater than 6 miles.

2032 *Route Study: Great Falls, Montana, to Anchorage, Alaska, Via Edmonton, Fort Nelson, Whitehorse, and Fairbanks During January and February*, September 1954. Prepared for 2nd Weather Group, Langley AFB, Va.

2217 *Interim Climatic Report No. 2*, August 1955. Prepared for Rome Air Development Center. Contains information on problems associated with high wind loading for periphery of North American continent north of United States, on Iceland, and on Greenland.

2410 *Weather for Aerial Photography in India*, April 1958. Prepared for Air Photographic and Charting Service (APCS).

2463 *Ballistic Meteorological Data for Antiaircraft Fire Control*, January 1957. Prepared for Fire Control Instruments Group, Frankford Arsenal. Consists of electronically calculated climatic statistics giving changes in ballistic winds and densities with height and time.

2478 *Weather Factors at Selected Satellite Visual Observation Sites*, August 1956. Prepared for Research

and Analysis Branch, Army Map Service. Evaluates nature and extent of weather effects on a part of the Vanguard satellite tracking project.

2479 *An Appraisal of Wind and Ice Conditions Along the DEW Line*, April 1957. Prepared for Air Material Command.

2809 *Frequency of Early Morning Plant Wetness (April-August) in the New Lands Area of the U.S.S.R.*, October 1957. Prepared for Army Chemical Corps Intelligence Agency.

2895 *Weather Factors Affecting Aerial Photography in Taiwan and the Kyukyu Islands*, March 1958. Prepared for Air Photographic and Charting Service (APCS).

3045 *Weather Factors Affecting Aerial Photography in Northern Japan*, July 1958. Prepared for Air Photographic and Charting Service.

3050 *Weather Factors Affecting Aerial Photography in Southern Japan*, July 1958. Prepared for Air Photographic and Charting Service.

3057 *Special Climatic Center Studies*, by Lt. Col. E.F. Corwin, Parts A through H, 1958-1964.

Part A "Suggested Methods of Applying Industrial Funds to the Special Projects of the (Climatic) Center," July 1958.

AFCCC Project Reports

Part B "Methods of Air Force-Navy Cooperation in Geophysical Data Acquisition and Deposition in the Space Age," July 1958.

Part C "Survey of Atmospheric Rocket and Satellite Data," May 1959.

Part D "Survey of Usefulness of the Climatological Microcard Program," May 1960.

Part E "Geophysical and Astrophysical Data Handling in Support of Future Weapons Systems," missing from files; not available.

Part F "The Apparent Direction that will be taken in the National Program in the Atmospheric Sciences, 1961-1971, as Recommended by the Petterssen Report, and the Influence this Report may have on the Climatic Center for the Same Period," July 1962.

Part G "Survey of Meteorological Rocket Network Measuring Techniques and Accuracies, Including Wind, Temperature, and Density Determination for the Period 1959-62," June 1963.

Part H "Survey of High-Altitude Rawin-Radiosonde Measuring Techniques and Accuracies and the Effect These Accuracies have on Wind, Temperature and Density Determinations in the Region of Overlapping with Meteorological Rocket Network Data," July 1964.

3069 *An Informal Bibliography on the Synoptic Climatology of the USSR and Certain Peripheral Areas*, June 1958. Prepared for 2nd Weather group.

3114 *Climo for Hamadan, Iran* (one page only--rest missing).

3173 *Visual Reconnaissance Conditions for the Northern Hemisphere*, April 1959. A broad hemispheric picture that considers two basic recon heights: 5,000 and 50,000 feet or higher.

3175 *Weather Affecting Aerial Photography of the Cape Verde Islands*, October 1958. Prepared for the 1370th Photo Mapping Group.

3351K *Weather Factors Affecting Aerial Photography in the Union of South Africa*, November 1959. Prepared for the 5th Weather Group, Westover AFB.

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3397 *A Bibliographic Handbook for Weather Reconnaissance System AN/AMQ-15*, July-August 1959. In two parts. Prepared for Bendix Aviation Corporation's Systems Division, AN/TMQ-15 contractor.

3640 *Estimated Frequencies of Specified Ceiling Height-Surface Temperature Combinations for Stations in Eastern Europe*, April 1960. Prepared for Staffmet, Wright Air Development Division, ARDC, through Staffmet, AFGL.

3679 *Dust Storms Occurring in the U.S.S.R. During March and April 1960*, May 1960. Prepared for the Central Intelligence Agency.

3751 *Evaluation of Favorable and Unfavorable Meteorological Conditions Affecting Sound Propagation at the Cape Canaveral Missile Test Area, Florida*, October 1960. Prepared for the Martin Company at the request of 4th Weather Group. To be used in missile engine testing.

3789 *Bibliographic Notes on Cloud in Russia and China in Relation to Synoptic Features*, September 1960. Prepared for AWSSS.

3819 *Weather Factors Affecting Aerial Photography in Sudan*, March 1961.

3871 *A Preliminary Report on the Climatology of Tropical Storms at Eglin and Patrick Air Force Bases*, August 1961. Prepared for AWS/DO to indicate probabilities of storms within 60 NM of designated APGC and AFMTC locations.

3873 *Methods for Determining the Probability of Radiological Doses from a Nearby Target*, April 1962.

3896A *Solar Flares and Terrestrial Phenomena*, April 1961.

3896B *Relationships Between Mean Critical Frequencies of the F₂ Layer and the Mean 50-mb Heights*, July 1961.

3900 *Winds and Temperatures at the 100 Millibar Level Between 50° North and 80° North*, February 1961.

3973 *Probability of Star Seeing in Nine Areas*, April 1961. Prepared for Air Photographic and Charting Service (APCS) to provide estimates of frequency of sky cover 3/10 or less and visibility 6 miles or more in nine areas of the world.

3975 *Ballistic Wind Variability*, August 1961. Prepared for Directorate of Operations, AFOOP-SV-FS, for an analysis of meteorological data applied to ballistics.

3993 *Diffusion Study*, June 1961. A study of the probable diffusion of IRFNA Vapors at a specified Bomarc Site. Prepared for 22nd Air Defense Missile Squadron, Langley AFB.

4100 *Precipitation Attenuation for 8 Kmc--Final Estimates*, February 1962. An analysis of weather effects on a communications system using 8-Kmc on beams elevated at least 5 degrees. Prepared for Rome Air Development Center, RAUO.

4101 *A Study of the Probable Diffusion of Aerosol Vapors at the 30th Air Defense Missile Squadron, Dow AFB, Maine*, November 1961. Prepared for ADC; provides estimates of downwind concentrations of inhibited red fuming nitric acid.

4103 *Diffusion Study, October 1961. Prepared for Plans and Management Office, OOAMA, Hill AFB, Utah*. Provides estimates of downwind concentrations of inhibited red fuming nitric acid at the Little Mountain Test Facility.

4114 *Frequencies of Onshore Wind Flow Over the West Coast of the U.S.*, November 1961. Prepared for the Army Chemical Corps. Indicates inland travel of aerosols released offshore.

4141 *Diffusion Study*, October 1961. Prepared for ADC. Provides estimates of downwind concentration of inhibited red fuming nitric acid spills at 26th Air Defense Missile Squadron, Otis AFB, Mass.

4155 *Estimates of Parameters Used in Equation (10) of Report 3975*, March 1962.

4167 *Diffusion Study*, December 1961. Prepared for ADC; same as 4141, but for 6th Air Missile Squadron, Suffolk County AFB, NY.

4278 *A Provisional Analysis of the Air Density Distribution over Patrick AFB to a Height of 400,000 Feet*, April 1962. Prepared for Det 11, 4th Weather Group.

4397 *Climatological Investigation of Density, Temperature, Speed of Sound, and Wind for Eniwetok and Ascension, to a Height of 300,000 Feet*, October 1962. Prepared for Space Technology Laboratories, Inc., to be used in CEP Test Firings Contract AF 04(691)-1 and -3 for targeting missiles to the Atlantic and Pacific Missile Range splash nets.

4432 *A Survey of Methods and Results in Studies of Magnetic Particles*, December 1962. Prepared For 4th Weather Group.

4461 *Supersonic Transport Environmental Factors, Part II, Ozone*, December 1962. Prepared for Douglas Aircraft Co. through ASD. To be used in FAA-NASA-DOD SST feasibility study.

4477 *Provisional Report on the Variability of Density, Pressure, Temperature, and Mean Molecular Mass at 90 to 125-km, Part I, Density*, January 1963. Prepared for Martin Company and the Aerospace Corporation, to be used in design of Dyna-Soar transtage propellant settling and attitude control systems.

4498 *A Method for Determining the Availability of Unimproved Landing Areas*, May 1963. Prepared as climatological support to OSR 407. Data used to compare areas annually, conditional on validity of the antecedent precipitation index, on an assumed uniform drying power, and on critical index value in all areas.

4586 *Estimation of Daily Ap Values from 3-Hourly K Values at Selected North American Stations*, May 1963. Results of a study to find the best combination of North American stations to use observations of K for estimating Ap, or to determine error in estimating Ap.

4668 *Probability of Occurrence of Ground Patterns of Thermal Radiation from High Altitude Nuclear Weapon Detonations*, July 1963. Final results expressed in terms of probability for Washington, DC.

4681 *Proposed Revision to the Uniform Summary of Surface Weather Observations*, February 1964. For AWSOP. Reviews changes recommended by AWS wings and groups.

AFCCC Project Reports

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4809 *Climatology of Solar Observatory Network*, January 1964. Prepared for AWSSS to determine best low latitude locations around the Earth for the placement of three to six solar observatories. Defines best areas from the standpoint of macroclimatology.

4824 *Frequency Attenuation Study*, January 1964. Prepared for McDonnell Aircraft Corp. through ASD. An analysis of meteorological effects on infrared, visible, and microwave radiation transmitted to altitudes of 70,000-100,000 feet over specified regions. Includes analysis of effects of IR radiation passing through a shock wave.

4847 *Total Cloud Cover, Africa and SE Asia*, March 1961. Prepared for AWSSS. Two sets of cloud cover charts are provided: one for North and Central America, the other for Southeast Asia and Indonesia. Data for French Polynesia is given in tables because frequencies and discontinuities between islands make isoline analysis impossible.

5090 *Cloud Cover Over Russia and China*, December 1965. Charts.

5112 *Density and Temperature Variability in the Upper Stratosphere and the Mesosphere*, 1965. Preprint issued as AIAA Paper 65-12 (1965).

5114 *Study of Wind Contribution to Errors in the Calculated Air Release Point at Cedar Hill Tower, TX*, 1965. Prepared for ASD through ASBW Staffmet. Determines effect of wind on errors in CARP for low-level paradrops. Phase I of a study of CARP weather inputs.

5115 *Cloudiness Study for Laminar Flow Control Applications*, December 1964. Prepared for ASD through ASBW Staffmet. Provides frequency of occurrence of clouds at two altitudes along four routes: Travis-Clark, Elmendorf-Dover, Dover-Panama, Dover-Rhein-Main.

5116 *Unusual Weather at Five Bases*, 1964. Prepared for AFSC/BSD to evaluate contractor's claim that there was unusual weather at five midwestern air bases (Columbia, Missouri; Grandview, Missouri; Ft Leavenworth, Kansas; Knobnoster, Missouri; Kansas City, Missouri) from 1962 to 1964. Tables compare "normal" with "observed" conditions.

5167 *Optimum October-March 7-day Outdoor Activity Period: Ramey AFB, Puerto Rico*, March 1965. This study answers the question, "When is the best seven-day period between October and March for outdoor activity at Ramey AFB, Puerto Rico." The answer is 10 through 16 March.

5426 *Cloud Cover Over Russia and China*, March 1966. A revision of Project 5090. Based on general POR of 3 years for Russia, 6 years for China.

5483A *An Appraisal of the McDonnell Aircraft Company Flight Path Atmosphere for a Boost-Glide Reentry Vehicle*, June 1966. Prepared For McDonnell Aircraft Co. and Ballistic Systems Division, AFSC.

5483B *Wind Shear and Turbulence over Selected Stations of the Northern Pacific Ocean*, August 1966. Prepared for McDonnell Aircraft Co. and Ballistic Systems Division, AFSC. Contains vertical wind shear data for three selected areas of the north Pacific, turbulence data, and an analysis of these data.

5501 *Temperature Characteristics at 30 Kilometers*, July 1966. Prepared for Space Systems Division, AFSC. Data to be used to form theoretical background for programs 681D, Advanced Space Guidance Program, Tak II, Horizon Scanner.

5519 *Cloud Cover over Southeast Asia and Australia*, November 1966. Extends Project 5426 (Cloud Cover over USSR and China) southeastward. POR varies from 3 to 10 years. Charts.

5525A *2/8 or Less Cloud Cover, US, Canada, and Alaska*, September 1966. Prepared for Det 1, 3WW, OL-A. Charts.

5534 *Climatological Support for System 447A*, July 1966. Prepared for ASD (ASBW). Includes mean monthly temperature and standard deviation for the 50-mb, 30-mb, and 10-mb levels of the northern hemisphere for an 18 by 72 grid. Provides information on moisture content for 70,000 to 85,000 feet.

5535 *The Climatic Pattern of South Vietnam*, July 1966. Prepared for the Institute of Special Studies, U.S. Army Combat Development Command, Ft. Belvoir. To be used for computer simulation of various aircraft performance capabilities under different weather conditions.

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5537 Construction of a Massive Grid Overlay for ESSA 2 APT Fax Charts, September 1966. An AWS supplement to the APT Users Guide (ESSA). Reprinted by ESSA with AWS permission.

5537B The Jet Stream Article. Missing--data unknown.

5537C Addendum to the Jet Stream Article, February 1967. An addendum to 5537B. Reprinted by ESSA with AWS permission.

5537D Positioning Surface Ridge Lines from Satellite Photographs, April 1967. Reprinted by ESSA with AWS permission.

5537E Estimating Upper Level Winds from Satellite Photographs, August 1967. Reprinted by ESSA with AWS permission.

5555A Flying Weather in Southeast Asia, August 1966. Prepared for OSD. Gives two categories of flying weather by month, plus general commentary.

5579 A Climatological Report on Winter Clear Air Turbulence for the United States, July 1967. Prepared as part of AWS FY 1967 Technique Development Plan.

5614 Interpretation of Tractionability Values Presented in ETAC Report 5399 for Vietnam and Thailand, October 1966. Prepared for Defense Intelligence Agency--to be used with Report 5399.

5617 Climatological Outlook for a Trip to the Far East and Europe During Mid-November thru Early December, undated.

5635B Tractionability Information--Southeast Asia, undated.

5645 Wind Speed Distributions for VTOL Aircraft Study, December 1966. Prepared for ASD (ASBW) and Controls Criteria Branch or the Flight Dynamics Laboratory, RDD. Gives average annual distributions of surface wind speeds by class for 266 stations in contiguous U.S., 65 overseas. Chart shows isolines of average annual percent of time (hours) that surface wind speed exceeds 22 knots.

5654 Weather Models for AWACS Radar Evaluation, December 1966. Prepared For Systems Engineering Group through Chief, Meteorology and Related Sciences

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Office, ASD. Two weather models for use in AWACS radar evaluation and analysis.

5655 Wind Statistics and Meridional Cross Sections for Viet Nam, January 1967. Prepared for Northrop Aircraft Corp. through AFSC. Statistical wind information for feasibility/cost analysis of rocket-launched, balloon-suspended, high altitude radio relay. Standard vector deviations and seasonal 50, 70, 90, 95, and 99 percentiles of mean vector wind and of east-west and north-south components provided for all available levels for Da Nang, Saigon, and Chiangmai (Thailand).

5662 Estimates of Indicated Air Speed to Obtain Optimum Weapon Release for Aircraft Flying at Low Level, December 1966. Problem: Given forecast pressure altitude and temperature for target, at what IAS should aircraft fly to hit target with weapon released a distance ("d") from target if aircraft is flying at a constant pressure altitude?

5665 Cloud Cover over Southeast Asia, April 1967. Expands Project 5426 (Cloud Cover over Russia and China) southeastward. Charts.

5725 Evaluation of the ITSA World Thunderstorm Maps, April 1967. Comparisons presented in tabular form for seven stations across the Northern Hemisphere.

5807 Radiosonde Dew Point Accuracies 40°C to -40°C, July 1967. Most literature gives accuracies in terms of relative humidity; this provides accuracies in terms of dew point. Prepared for ASD.

5815 Monthly Standard Deviation of Hourly Sea Level Pressure (mb), Northern and Southern Hemispheres, 1 April 1969. Oversized.

5850 Working Paper for the Revision of MIL STD 210A, "Climatic Extremes for Military Equipment" (1KM to 30KM), June 1971. A backup document from which a portion of the final publication will be extracted. Statistics based on or evaluated from atmospheric sounding data on file at ETAC, DPD, and NCC. (AD-E850691)

5892 Part I, Off-the-Road Trafficability Percentages (Sept-Oct), October 1967. A study of trafficability with regard to movement of 2- to 5-ton vehicles during and immediately following precipitation during September

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and October at Dong Hoi, North Vietnam, Huc, South Vietnam, and Seno, Laos.

5913 *Density Variability: Temporal and Spatial*, June 1970. Prepared for 6WW. Density continuity graphs for 30, 40, 50, and 60 km for Northern Hemisphere USAF Environmental Rocket Sounding System stations based on their 1968 data.

5954 *Atmospheric Water Content*, December 1967. Gives distribution of atmospheric water content (liquid and vapor) for use in determining liquid water ingestion specifications for V/STOL engines.

6062 *Edwards AFB Mountain Waves*, May 1968. Prepared for Det. 21, 6WW, in support of NASA laser probe tests.

6064 *Adverse Weather Models*, August 1968. Prepared for Meteorology and Related Sciences Office, ASD, specifically for identification and attack of ground targets with emphasis on night and adverse weather mission analysis and study program.

6067 *Climatology Tables and CFLOS Data--Korea*, 15 May 1968.

6073 *Gulf Trajectories*, May 1968. Prepared for Det 23, 6WW, Kirtland AFB. Gives probability of a particle dropped from 24,000 feet at 28° 30'N, 86°W, falling 2,000 feet/hour and landing in indicated areas. Gives estimates of regime's persistence frequency.

6077A *S.E.A. Visibilities*, June 1968. For ASD/ASW: Frequency of occurrence of visibilities below 7 miles, by reporting category, during daylight hours for three stations in North Vietnam. Also tops of fog and haze layers, by season, for the same stations.

6078 *Cloud Study for Selected Stations in China*, June 1968. Climo data for three stations: 52446 (Ting-Hsin), 52267 (Soh Kuo Nor), 52378 (name unknown).

6083 *The USAF Environmental Rocket Sounding System Data equality Control and Data Reduction*, by Lloyd V. Mitchell, August 1968. An updated version of a paper presented at the 13-17 May 1968 WMO Symposium on Data Processing for Climatological Purposes, Asheville, North Carolina.

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6086 *SEA Cloud Data*, July 1968. Prepared for AMSMI-RRA, Army Missile Command. Mean cirrus heights for Danang, other data.

6102 *Density Altitude (Selected Areas)*, by Paul G. Crotty, August 1968. Prepared for AFSC (SCLAT) to be used in helicopter design: Frequency with which density altitude exceeds 7,000, 6,000, and 5,000 feet for hottest month and for the year in Laos, Pakistan, West Germany, Turkey, Colorado, Bermuda, and Wake Island.

6106 *Rain Probabilities for Between 25-33°N and 80-100°W in Comparison to a Wind Regime from Surface to 7 km From Any Direction Located Over 28°-30°N, 86°-00°W*, September 1968.

6118 *Density Altitude Climatology, Greece, France, Norway*, by Capt. Shoji Takasugi, November 1968. Prepared for HQ USAF (AFCSA) to evaluate aircraft performance in certain NATO countries.

6119 *Color Enhancement of Nimbus High Resolution Infrared Radiometer Data*, by Maj. Earl R. Kreins (ETAC) and Lewis J. Allison (Goddard Space Flight Center), March 1969. GSFC X-622-69-86, preprint.

6134 *Environmental Design Information*, 5 March 1971. Covers 18 locations. Project originally opened 24 October 1968 for GEEIA (Ground Electronic Engineering Installation Agency), but evolved into one that supplied general environmental design data on a continuing basis. With project closing, all further requests for similar information to be answered under separate projects.

6142A *Photo-Reconnaissance Climate Analysis*, November-December 1968. Prepared for USAF Tactical Air Reconnaissance Center. Climatic maps of ten countries showing area of representativeness of each of 77 stations listed in CL 9697.

6180 *Northeast Atlantic Precipitation Base*, by Allen R. Davis, December 1968. Rainfall rate analyses prepared for Chief of Naval Operations, Center for Naval Analyses. For use in connection with antimissile systems attenuation studies.

6201 *Probability of On-Shore Flow with "Sea Breeze" effects for Coastal United States*, by Maj. Gordon A.

Beals, January 1969. Gives statistics of probability of onshore wind components (5-15 knots) at representative locations on U.S. coasts.

6239 *Climatological Information for Southeast Asia*, April 1969. General climatology, prepared for a DoD agency through ETAC Pentagon Liaison Officer. Charts and tables.

6247 *Environmental Data For Hot Climates Outside the U.S.*, by Maj. Gordon A. Beals, May 1969. Attempts to provide actual data on combined occurrence of high temperatures and strong thermal radiation outside CONUS; discusses sources and applicability of the data.

6282 *Comparison of Carrier Vs Land Base Weather*, by Capt. Shoji Takasugi and TSgt. Zapf, July 1969. Prepared for TAC Air Review Group. Compares locations in North Sea, Tonkin Gulf, and Mediterranean with Hahn, Stuttgart, Bien Hoa, Danang, and Aviano.

6287 *Spatial Continuity of the Maritime Inversion at Vandenberg AFB*, by 1st Lt. Richard R. Babcock, Jr., January 1970. Prepared to help resolve diffusion problems at the USAF Western Test Range.

6291 *Fumigation Process Associated with Maritime Inversions Along the California Coast*, by Maj. Gordon A. Beals, August 1969. Prepared for USAF Space and Missile Systems Organization (SAMSO).

6295 *Anomalous Propagation of Radar Waves at Chiang Mai, Thailand*, by Capt. Shoji Takasugi, July 1969. Prepared for USAF Director of Operations.

6296 *Photo Recon Cloud Study*, by Allen R. Davis, December 1969. Prepared for Ops Analysis Section of Tactical Air Reconnaissance Center. Gives cloud and visibility data for study of operational utility of electrooptical sensors.

6299 *Climatology of the USSR-Sinkiang Border Area*, August 1969. For Pentagon Command Post.

6316 *Characteristic Temperature Profiles for Jungle Areas of South Vietnam*, by Maj. Gordon A. Beals, March 1970. Prepared for 1WW; used in supporting herbicide missions.

6326 *Environmental Weather Data for the Fulda Area of Germany, Jan-Apr-Jul-Oct*, by Capt. Max H. Peek, October 1969. For ACSI-TE.

6343 *Standardized Rawinsonde Reduction Program*, by Capt. James C. Ashby, Harry P. Averill, and Lt. Charles von Flotow, October 1970. Describes the rawinsonde numerical reduction program RAWINX, written in FORTRAN IV for IBM 7044.

6343B *Rocketsonde Data Reduction*, by Capt. Ronald D. Novotny and MSgt. Glen Grazier, October 1970. Describes the standardized rocketsonde EDP program that produces coded data in WDCA-1 format.

6344 *Cloud Cover Over the Mekong Delta for Nighttime Visual Reconnaissance*, November 1969. For a DoD agency through the Pentagon Liaison Officer.

6353 *Frequency of Hurricanes in Reconnaissance Zones*, December 1969. Gives frequency that hurricanes enter various air recon zones along Atlantic and Gulf coastal regions of United States. For SAES.

6363 *CFLOS and Precipitation Data for Site Selection Study*, by Capt. Patrick O'Reilly, January 1970. For SAMSO's use in selecting site that provides best line-of-sight communications to a synchronous satellite.

6368 *Low Cloud Icing Climatological Data*, by Capt. Shoji Takasugi, January 1970. Climatological data of seasonal cloud types and amounts and the seasonal range of the 0° isotherm in the vertical for ASBW, Wright-Patterson AFB, Ohio. To be used in icing condition tests over England and northern Germany at levels from 500 to 4,000 feet.

6375 *Estimated Probabilities of Path-Cumulative Rain Intensity for Paths of 10 and 22 Nautical Miles in High Rain-Rate Areas*, by Maj. Gordon A. Beals, June 1970. (Also FAA-RD-70-55). Prepared to assist ICAO's Radio Communication Special Committee 117 in selecting a frequency band for a common military/civilian instrument landing system. Study restricted to distribution of rain-sized water drops--would not apply to problems requiring an estimate of the total mass of liquid water in cloud systems.

6382 *Frequency Percentages of Specified Ceilings in Areas, Worldwide*, by Capt. Shoji Takasugi, February 1970. Prepared for AFRDQ M1 for percent of time ceilings are less than 2,000 and 8,000 feet for the best and worst months, and annual average. To be used as input to all-weather weapon system study.

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6391 *A Discussion of Certain Weather Parameters for Selected Areas of Southeast Asia*, by Capt. Edward D. Heath, March 1970. Prepared for Westinghouse Electric Corp. under ARPA Contract FO 806-70-C-0020. Includes thunderstorm, wind, air density information for selected areas in Southeast Asia. Charts, tables.

6395 *Evaluation of Design Winds*, by Dean W. Bowman, March 1970. Prepared for ARPA. 3-Sigma wind profiles for selected locations.

6457 *Precipitation Data for Radar Evaluation Studies*, by Maj. Gordon A. Beals, Capt. Patrick J. O'Reilly, and Allen R. Davis, April 1971. Prepared for ASD. Statistics on frequency and areal extent of various precipitation rates for 160 locations worldwide.

6466 *An Analysis of Meteorological Conditions in the Mekong Delta in Late May and Early June 1970*, July 1970. For Defense Communications Planning Group.

6467 *Adverse Weather Models*, by Capt. Patrick J. O'Reilly, October 1970. A revision of Report #6064, August 1968.

6492 *Acid Mist Association with a Titan III-D Missile Launch*, by Lt. Paul G. Shapin, February 1971. For Space and Missile Test Center (SAMTC). Gives information on deposition of HCl acid caused by launching TITAN III-D missile into stratus deck.

6506 *Precipitation Models for SAFSCOM*, by Capt. Patrick J. O'Reilly, December 1970. Probability models in terms of liquid water content for Miami and selected areas in northern and central Plains states. For Martin Marietta Corp and Bell Telephone Labs to determine SPRINT missile performance.

6523 *Vandenberg Gust Summary*, by Maj. David S. Lydon, March 1971. Peak wind data for Det 50, 6WW, structural integrity study on freestanding missile.

6569 *Climatological Data for Korea and the Northeast CONUS*, by Capt. Richard C. Wagner, February 1971. For RADC in determining locations in Northeast US that are climatologically analogous to five Korean sites.

6575 *Determination of Maximum Emission Rates to Meet Air Quality Standards*, by 2nd Lt. A. Robert Greenway and Maj. David S. Lydon, June 1971. A study

of atmospheric diffusion and its influence on maximum allowable stack emissions--for Hq USAF.

6613 *Clark AFB Precipitation Rates*, September 1968.

6659 *Pioneer F Fallout*, by Maj. David S. Lydon and Lt. Dennis A. Trout, November 1971. A meteorological analysis of the nuclear safety aspects of a Pioneer F space mission launch--for Air Force Weapons Laboratory.

6665 *Environmental Impact Analysis, Hill AFB*, by Lt. A. Roger Greenway, August 1971. An analysis of ventilation and diffusion elements from Little Mountain, Utah--for AWS/DNP.

6673B *Linear Regression Techniques Applied to Climatological Aids to Forecasting*, by Capt. John L. Conley and 1st Lt. Dennis A. Trout, August 1972.

6673C *An Attempt to Find Objective Predictors to Forecast the Nature of Winter Storms*, by Capt. Shoji Takasugi, February 1973. Study confined to Hanscom Field and Andrews AFB--for 6WW/DN.

6705 *Air Pollution Emissions from Noise Suppressors for Engine Test Stands and Aircraft Power-Check Pads*, by Maj. David S. Lydon, Lt. A. Roger Greenway, and Lt. Dennis A. Trout, November 1971. For USAF Environmental Health Lab, McClellan AFB, Calif.

6765 *Aircraft Noise Pollution*, by 1st Lt. Dennis A. Trout, April 1972. For 17WS.

6821 *Pollution Resulting from Warm Fog Dissipation by Jet Engine Exhaust*, by 1st Lt. Dennis A. Trout, May 1972. Estimates air pollutant concentrations produced by jet engines used to aid in warm fog dissipation at Travis AFB, Calif.--for AWS.

6988 *A Technique to Specify Liquid Water Content at a Point in the Atmosphere*, By Capt. Robert G. Feddes, June 1973.

7044 *Drone/RPV Automatic Landing Guidance System Climatology*, June 1973. Supports Requirements Definition Study of Drone/RPV Automatic Landing System--for AFFDL.

7053 *Stability Wind Roses, Luke AFB, AZ, 0000-2400 LST*, October 1973. An analysis of stability in lowest layers for use in an air pollution study.

7070 Stability Wind Roses, Langley AFB, VA, 0000-2400 LST, October 1973. An analysis of stability in lowest layers for use in an air pollution study.

7110 Special Climatic Report for NATO Remotely-Piloted Vehicles Concerning Weather Factors in Germany, by SMSgt. Luther M. Cantrell and MSgt. Marilyn V. Robinson, August 1973. For AGARD through AFSC.

7121 Cyanometric Application to Photographic Reconnaissance, by Capt. K. Nozacki, September 1973. An analysis of the historical and theoretical application of an optical cyanometric device having an internal scale for determining the "blueness" of the sky--for AF Avionics Laboratory.

7136 Lowest Observed Frequency (LOF) Study, by Capt. Vernon G. Patterson, June 1974. For 15th Communications Squadron (AFCS).

7222 Scheduling a Work Week to Conserve Energy, by Capt. Thomas E. Fraser, April 1974. An interim paper that addresses the May-October cooling season. (AD-E850471).

7230 Estimates of the Seasonal Distributions of One-Way Cloud and Rain Attenuation of K_v Band Radio-Wave Transmissions over a 200-mile Slant Path in Central Europe, by Allen R. Davis, January 1974.

7232 Cloud-Free Line-of-Sight Probabilities for Selected Surveillance Sites, February 1974. Mean CFLOS probabilities for four time periods by month for six sites--for AF Avionics Laboratory.

7250 Specific Weather Frequencies in the East-West European Border Zone, January 1974. Cloud cover and visibility categories consolidated from selected locations to provide representative data along the northern plains and central highlands portion of the East-West border.

7261 Solar Illumination Calculator, by Capt. Richard A. Goldsmith, February 1977. Develops model of earth's orbital relationship to sun. (AD-A040091)

7280 An Evaluation of the Map-Type Conditional Climatology Tables, by Capt. Michael J. Kelly, Jr, SMSgt. Luther M. Cantrell, and SMSgt. Marilyn V. Robinson, July 1974. Prepared for AWS/DN through

6WW/DNT. General format of test specified in AWS Programming Plan 74-03, AWS Map-Typing Program.

7294 Reduction of Air Conditioning Season to Conserve Energy, by Oscar E. Richard, Hilda J. Snelling, and Lt. William F. Marken, March 1974.

7295 Power-Plant Plume/Visibility Study for Offutt AFB, by Capt. Kenneth Y. Nozacki and Maj. Robert E. Dettling (Revised by Nozacki and Capt. Daniel J. McMorrow), September 1976. Analysis of effects of a 650 megawatt power plant planned for 8 km North-Northeast of Offutt AFB, Neb., traffic pattern--for 3WW.

7310 Hail Prediction using Statistical Methods for Specified Domestic Stations, by 1st Lt. Daniel J. McMorrow, April 1974.

7318 Objective Wind Forecast Study for Kelly AFB, Texas, by Murray J. Young, May 1975. A study for predicting occurrence or peak winds equal to or greater than 25 knots at Kelly AFB, Texas. For Det. 7, 15WS.

7343 Atmospheric Vertical Motion, Edwards AFB, California, by Maj. David S. Lydon and Capt. Kenneth Y. Nozacki, August 1974. An analysis of vertical motion concerned with computing drag and lift for various angles of attack on B-1 airframe. For ASD.

7408 Boundary Layer Models and Data for RPV Autoland Simulations, by Capt. Kenneth Y. Nozacki and Maj. Robert E. Dettling, October 1974. Presents atmospheric stability classifications and surface wind exceedance values for different Koppen climatic regimes, associated distribution of mixing depths of surface boundary layer, and neutral case wind shear and turbulence models important to designing the RPV autoland system. For AFFDL.

7441 Hill AFB Insecticide Diffusion Study, by Capt. Kenneth Nozacki, September 1974. Studies dispersion of Sevin sprayed from C-123.

7449 Study of Hail Frequency Distributions for St Louis, Mo. Area, by 1st Lt. Daniel J. McMorrow, August 1974. For AWS.

7456 Skiing Climatology for the Vail Skiing Resort, Colorado, by SMSgt. Luther M. Cantrell, September 1974. Data for Vail, along with aircraft landing and protection data for Denver--for the White House.

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7490 A Line Source Model for Assessing the Gravitational Settling/Diffusion Model Associated with Aerial Spraying Operations, Maj. Robert E. Dettling, April 1975. For AF Directorate of Civil Engineering in determining "envelopes" to be expected from spray operations and weather conditions.

7538 Modeled Peak Gust Conditional Probability Values, by Murray J. Young, January 1975. Prepared for 3WW/DN in support of Army Safeguard System Command. Model related peak gust probability to geostrophic wind speed 2 hours in advance.

7584 A Model for describing the Atmospheric Water Vapor Profile Above the -40° Temperature Level, by Capt Laurence D. Mendenhall, Maj. Thomas E. Stanton, and 1st Lt. Harry W. Henderson, August 1975. Prepared for AWS/SYJ to satisfy operational requirements stated by users of AWS point analyses.

7584A Appendix 3 to USAFETAC Report 7584, Effects on Infrared Transmission, by Capt. Laurence D. Mendenhall, May 1977. Gives results of analysis of transmissivity in the 2.95 micrometer band through the stratosphere and upper troposphere.

7604 Potential Ground Contamination by Fuel Jettisoning from the F-15, by Lt. Richard W. Fisher, May 1975. Prepared for 5WW.

7621 An Analysis of the Spacial [sic] Variation of Selected Parameters in the Federal Republic of Germany, by Capt. Timothy M. Laur, December 1975. Prepared for ACS/Studies and Analysis. Investigates validity of using observations from one location to represent clouds and visibility at another. Area of interest is a part of western Europe centered in the Eifel Mountain region.

7639 A Meteorological Assessment for Aerial Spraying Operations at Langley AFB, Virginia, by Maj. Robert E. Dettling and 1st Lt. Richard W. Fisher, May 1975. Prepared For Hq USAF Directorate of Civil Engineering, 355th TAS Spray Squadron, AWS/DN.

7641 A Simplified Meteorological Assessment for Spraying Dibrom at Homestead AFB, Florida, by Maj. Robert E. Dettling and 1st Lt. Richard W. Fisher, June 1975. For AWS/DO.

7659 Vietnam Equipment Corrosion Climatology, by Capt. Thomas E. Fraser, May 1975. For Defense Intelligence Agency.

7663 A Simplified Meteorological Assessment for Spraying Malathion at Guam, by Maj. Robert E. Dettling, May 1975. For 355th TAS Spray Squadron.

7668 A Simplified Meteorological Assessment for Spraying Dobrom at Aberdeen Proving Ground, Maryland, by 1st Lt. Richard W. Fischer, June 1975. Prepared for Hq USAF Directorate of Civil Engineering, 355th TAS Spray Squadron, AWS/DN.

7669 A Simplified Meteorological Assessment for Spraying Dibrom at Robins AFB, Georgia, by 1st Lt. Richard W. Fisher, May 1975. Prepared for Hq USAF Directorate of Civil Engineering, 355th TAS Spray Squadron, AWS/DN.

7681 Environmental Effects on 4/6 GHz ANIK II Satellite Communication Links Between Greenland and California, by Capt. Donald G. Buchanan, August 1977. Addresses effects on propagation of radio energy From P-Mountain, Greenland, to Point Reyes, California.

7685 A Simplified Meteorological Assessment for Spraying Sevin for Japanese Beetles at Dover AFB, Delaware, McGuire AFB, New Jersey, Patuxent NAS, Maryland, by Maj. Robert E. Dettling, June 1975. For AWS/DO.

7687 A Meteorological Assessment of High-Explosive Tests Near Richards-Gebaur AFB, Missouri, by Maj Robert E. Dettling, June 1975. Prepared in support of Project HARDPAN for Air Force Weapons Laboratory.
7700 Atmospheric Transmittance in the 8-13 Micron Band, September 1975. Gives total transmittance along various slant paths for selected locations. Prepared for Det 1, AWS, with LOWTRAN2.

770Y A Blast Propagation Assessment for High-Explosive Tests at Trading Post, Kansas, by Maj. Robert E. Dettling, SSgt. Daniel J. Sheldon, and Amn. Carole A. Stamey, November 1975. For Air Force Weapons Laboratory in support of Project HARDPAN, a test series designed to evaluate missile silo survival.

7742 A Simplified Meteorological Assessment for Spraying Dibrom at Tyndall AFB, Florida, by Capt. Richard W. Fisher, August 1975. Prepared for Hq USAF Directorate of Civil Engineering, 355th TAS Spray Squadron, AWS/DN.

7755A A Climatology of Wind Shears, Part A: Air-Mass Wind Shear in the United States, by Capt. Timothy M. Laur, June 1977. Data requested by AWS to support development of Low-Altitude Wind Warning System (LAWWS).

7768 Estimated Wind Funneling Effects at Kelly AFB, Texas, by Murray J. Young, January 1976, 16pp. Prepared to solve a specific problem; not expected to have application beyond that problem.

7845 Distributions of Transmission (Percent) for the 8-12 and 1.06 Micron Regions at Stuttgart, Germany, for the Imaging Infrared/Laser Study, February 1975. Climatological distributions of transmission data given for Imaging Infrared/Laser Study of AGM-65 Maverick missile. Prepared for HQ USAF Assistant Chief of Staff for Studies and Analysis with LOWTRAN3.

7903 Data Availability Investigation for Maine Wind Gust Study, by Murray J. Young, February 1976. A wind gust model for General Electric Engineering (through ESD) to help in determining vibrational effects of wind on antennas and supporting structures.

7920 Improvement and Use of the Aerial Spray Assessment Model, by Maj. Robert E. Dettling and 2nd Lt. Allen H. Kikawa, May 1976. Documents improvements and use of USAFETAC Report 7490, April 1975. Main improvements: Addition of FORTRAN statements that analyze computed deposition fields automatically and selection of more representative downwind x-grid spacing. Includes spray study for Guatemala.

7966 REFORGER 76 Support, by Murray J. Young, August 1976. Follows development of a programmed climatology program (CLIMO) and touches on its use in a tailored support program (TAILOR). For AFGWC input into REFORGER MSI production system.

7979 Senegal Aerial Mapping Project, by Dean Bowman and TSgt. Don K. Kugler, June 1976. Prepared for Defense Mapping Agency. Includes data on clouds, visibility, river flooding.

8002 Meteorological and Gravitational-Setting Estimates for USAF Aerial Spray Operations, by Capt. Richard W. Fisher, June 1976. Provides estimates of centerline ground-level concentrations of pesticides sprayed from aircraft for 18 locations in CONUS.

8006 Checklist for Determination of a Hazard Corridor for an Accidental Toxic Chemical Spill, by Capt. Arnold L. Friend, February 1977. Using methods in AWS TR 176 (as modified by 3WW), provides a simple checklist to predict hazard corridors for accidental toxic spills.

8019 Ceiling and Visibility Climatology of Ocean Areas, July 1976. Prepared for Armament Development and Test Center for use in B-52 anti-shipping capabilities study.

8035 An Evaluation of Several Models for Describing the Atmospheric Water-Vapor Profile Above the -40° Temperature Level, by Capt. Laurence D. Mendenhall, May 1977. The results of investigation into a simpler model for use in the point analysis program.

8044 A Post-Blast Propagation Assessment for High-Explosive Operations Near Cornell, Oklahoma, by Capt. Timothy M. Laur, June 1976. Prepared for Hq USAF Staff Judge Advocate.

8065A REFORGER 77 Support, Part A: An Independent Test of the REFORGER 76 Support CLIMO Program, by Murray J. Young, January 1977. Maximum difference between modeled and observed climatology compared; significant differences found.

8065B REFORGER 77 Support, Part B: Test of a Suggested Approach to Spreading Climatology to Grid Points, by Murray J. Young, March 1977. A study of differences between two closely spaced stations is used to test hypothesis that climatology for both is the same. Hypotheses not proved true in all cases.

8135 Rain Attenuation Distribution for Key West, Florida, September 1976. Tables showing attenuation rates and total two-way attenuation over a 75-NM path by rain rates at key West in number of occurrences and percent of time. Comments, conclusions.

8141 Some Estimates of Precipitation Rates at Selected Locations, by Capt. Daniel J. McMorro, September

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1976. Prepared for SAMSO to aid in selecting test site from among several CONUS locations.

8225 *Trip Climatology for a Flight from Canberra, Australia, to Great Falls, Montana, December 1976--January 1977*, by MSgt. John E. Lein, November 1976. For USAFLO/CINCPAC-REP, Canberra--for C-131D flight, legs and stops and indicated.

8234 *Extreme Winds and Their Vertical Profile at SLC-6 Launch Pad, Vandenberg AFB, California*, by 2nd Lt. Tamzy J. Cunningham, February 1977. Prepared to aid in determination of wind loadings for launch complex. For SAMSO.

8236 *Arabian-California Atmospheric Comparison*, by Allen R. Davis, December 1976. Compares upper-air humidities for 20 to 25 September 1976 at Miramar NAS with those for Jeddah, Saudi Arabia.

8252 *Checklist for Determination of a Hazard Corridor for an Accidental Toxic Chemical Spill or Release of a Chemical Agent*, by Capt. Arnold L. Friend, July 1977. Supersedes USAFETAC Report 8006, February 1977.

8290 *Estimates of Precipitation Rate Distributions for Selected USSR Stations*, by Allen R. Davis, February 1977. Gives 1-minute and clock-hour precipitation rates for 11 stations in USSR. Includes precipitation attenuation, mean freezing level heights, precipitation frequencies.

8343 *A Rainfall and Cloud Climatology for Indonesia*, by CMSgt. C. Marshall Carter, June 1977.

8345 *Estimates of Satellite-to-Earth Microwave Attenuation by Cloud, Rain, Oxygen, and Water Vapor*, by Allen R. Davis, April 1977. Examines attenuation of microwaves, 58-62 GHz and 92-96 GHz--for RADC.

8362 *A WWMCC'S Support for USEUCOM, A Proposed Automated Climatological Data Base for Europe*, by Capt. Richard A. Goldsmith, April 1977. Prepared in response to USEUCOM ROC 12-72.

8373 *Severe Winter and Drought, 1976-1977*, by Capt. James G. Schofield, March 1977. A comprehensive study of the 1976-77 phenomenon. Maps, charts.

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8413 *Buckley Dew-Formation Study*, by Capt. Arnold L. Friend, June 1977. Estimates percent frequency of occurrence of frost on a radome.

8481 *Estimates of K_u Band Attenuation over the Oceans*, by Capt. Daniel J. McMorrow, July 1977. Satellite-derived rainfall rates used to estimate attenuation for 20° latitude by 20° longitude blocks. Seasonal charts of frequencies of 3-, 6-, and 9-dB attenuation values included.

9708 *Environmental Design Information for Microwave Equipment Sites in Spain*, by Oscar E. Richard, Hilda J. Snelling, and Lt. William F. Markert, June 1974. Prepared for ESD in support of the COMBAT GRANDE Microwave equipment site location program.

9710 *Environmental Design Information for Air Force Satellite Communications System Sites*, by Lt. William F. Markert and Hilda J. Snelling, September 1974. Prepared for AF Avionics Laboratory in support of Program 1201, AF Satellite Communications System.

9712 *Environmental Design Information for the Joint Surveillance System*, by Oscar E. Richard, Hilda J. Snelling, Lt. William F. Markert, and SMSgt. Owen B. Addington, December 1974-June 1975. For ESD.

USAFETAC-PR-78-001 (AD-A099664) *A Climatology of Monthly Mean Sea Surface Temperatures for the Gulf of Mexico*, by SSgt. Anthony J. Baltz, January 1978, 15pp. Gives monthly mean sea surface temperatures for the Gulf of Mexico in 1 degree quadrangles.

USAFETAC-PR-78-002 (AD-A051981) *Point Warning Climatology of Mt. Laguna, California*, by Capt. James R. Clark, January 1978, 6pp. An analysis of a 17-year period of record for weather warning criteria. Discusses four major storm types that affect southern California and gives monthly climatological values of temperature, precipitation, and wind for individual warming elements.

USAFETAC-PR-78-003 Not used.

USAFETAC-PR-78-004 (AD-A097113) *Sizing an Environmental Data Set*, by Maj. Elden C. Taylor, April 1978, 4pp. Gives basic equation and four derivations that can be used to size environmental data sets.

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Equations formulated to document mass storage requirements for USAFETAC support to WWMCCS, but have wider applications.

USAFETAC-PR-78-005 Not used.

USAFETAC-PR-78-006 Not used.

USAFETAC-PR-78-007 (AD-None) *An Objective Technique for Spreading Climatology*, by Capt. Arnold L. Friend, June 1978, 4pp. Errata 2 April 1980. Describes an objective analysis technique for modeling climatic probability of September ceiling and visibility at various threshold values, individually and jointly, for any area or point in Germany. The model, 4DCLIM, requires input of modeled station data, threshold values for the weather elements, and geographic information that defines the point or area of interest. Modeled station Data obtained by fitting a curve to observations at a given station at a specific hour and month for each weather element. 4DCLIM model designed to support REFORGER 78, but has wider application.

USAFETAC/PR-79/001 (AD-096417) *Vandenberg Air Force Base "Winds" Comparison Study*, by Capt. James R. Clark and Capt. Julius A. Jackson, March 1979, 31pp. Vandenberg's "WINDS" Tower 301 was to provide data for space shuttle launch, but had shorter period or record than Tower 300 a few miles north. Study investigates feasibility of creating bogus POR for Tower 301 with Tower 300 data.

USAFETAC/PR-79/002 (AD-080922) *Climatological Narratives for U.S. Air Force Installations*, by Maj. James R. Clark and Sgt. Rudolph Arriaga, December 1979, 35pp. Climatological narratives (aerial spray) for 44 USAF installations. Includes wind speed/direction; maximum, minimums, mean temperatures; other elements. Discusses topography, local terrain, and their effects on local climate.

USAFETAC/PR-80/001 (AD-A085525) *Cloud Cover and Visibility Climatology for the Philippines*, by SSgt. Daniel E. Mitchell, May 1980, 14pp. Provides cloud cover and visibility climatology for 19 locations in the Philippines. Mean number of days with total cloud amount less than or equal to 1/10 and visibility greater than or equal to 6 miles for each month and by hour of day given for each location.

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USAFETAC/PR-81/001 (AD-A104065) *Mean Annual Snowfall at Air National Guard Bases, 1950-51 to 1978-79*, by 1st Lt. Gregory D. Schmit, 2nd Lt. Carlton F. Brown, Jr., and TSgt. Mark Hamburger, April 1981, 144pp. Summary includes annual snowfall for 139 ANG bases in U.S. and Puerto Rico from 1950 to 1979.

USAFETAC/PR-81/002 (AD-None) *Cloud Cover and Visibility Climatology for Egypt*, by SSgt. Dale E. Mitchell, April 1981, 33pp. An analysis of cloud cover less than 10 percent and visibility greater than 6 statute miles to show best seasons for aerial photo over Egypt. Summer best for interior; late autumn and winter best over coastal areas. Northern Red Sea coast north of Port Sudan is exception--could be photographed in winter.

USAFETAC/FR-86/001 (AD-A167576) *Design Wind Analysis, Project 387402*, by Capt. Robert D. LaFebre, March 1986, 18pp. Provides a comprehensive literature review on methods of design wind analysis. Report notes there is no "best way" to raise winds from one level to another, pointing out that meteorologists and engineers have separate preferences. Notes also that while one method may work well for one investigation, it may result in false conclusions when used for another.

USAFETAC/PR-86/002 (AD-B102926) *Cloud-Free Line-of-Sight Simulation Models (Users Manual)*, by Capt. Dewey E. Harms, May 1986, 30pp. Provides information necessary to run cloud-free line-of-sight (CFLOS) simulation models CFLOS4D and CFARC, as well as to understand and interpret model output. These simulations were developed to perform sensitivity analyses of potential ground-based lasers (GBLs) by generating downline statistics for systems consisting of one or more sites. *Distribution authorized to the Department of Defense and DoD contractors only, critical technology, 15 May 1986. Other requests shall be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801. WARNING--This document contains technical data whose export is restricted by the Arms Control Act (Title 22, U.S.C., Sec 2751 et seq) or Executive Order 12470. Violations of these export laws are subject to severe criminal penalties.*

USAFETAC/PR-86/003 (AD-A169651) *A Simulation Feasibility Study*, by 2nd Lt. Kevin L. Witte, June 1986, 14pp. The results of a pilot study performed for the Air Force Aerospace Medical Research Laboratory to

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determine the feasibility of simulating Pasquill Stability Index, wind speed, cloud cover, and wind direction for a diffusion model. Author concluded that wind speed and direction should be modeled together, but that cloud cover should be modeled separately because of the low correlation between cloud cover/wind speed and cloud cover/wind direction. Wind speed and cloud cover, according to the author, can be used to simulate a Pasquill Stability Index.

USAFETAC/PR-87/001 (AD-A183376) *Cumulus Cloud Dimension Statistics for New Orleans, Essen, and Hannover*, by Capt. Randell J. Barry, June 1987, 68pp. Cumulus clouds at New Orleans, LA, and at Essen and Hannover, West Germany, are analyzed for mean, maximum, and minimum cloud base heights, cloud top heights, and cloud cover amounts using 10 years of USAFETAC DATSAV data. Frequency of occurrence statistics are also calculated. Statistics are produced for each of three different cumulus types (cumulus humilis/fractus, cumulus mediocris/congestus and cumulonimbus) in two categories: monthly, and hourly by season. Cloud tops are determined from a simple one-dimensional cumulus cloud model. All other cloud dimensions are obtained from surface weather observations. Methods used in determining the statistics are discussed and statistical limitations are noted.

USAFETAC/PR-87/002 (AD-B116398) *Global Transmissivity Study for Electrooptical Weapons Systems in the 8-12 and 3-4 Micron Bands*, by Maj. Roger T. Edson, Richard H. Grumm, and 1st Lt. John G. Miller, Jr., September 1987, 179pp. LOWTRAN6 was used to compute 10-year climatologies of atmospheric transmittance at the 8-12 and 3-4 micron frequency band for 16 stations and four geographical regions. A standard geometry or a 12.5m AGL sensor height and a 4km slant range was assumed. For most midlatitude locations, the 8-12 micron band offered higher transmittance values than the 3-5 micron band. For tropical locations and in regions where absolute humidity was much higher than 12gm^{-3} mean transmittance at 3-5 microns was equal to or better than at 8-12 microns. Overall, the trend in both IR bands showed higher transmissivities in winter and spring, lower in summer and fall. Results appeared to be directly related to monthly mean dew point or absolute humidity. The study also found considerable diurnal dependency in the data, with a minimum mean transmissivity in the morning. Examination of relative frequency or

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occurrence for bad to good transmittance values revealed a strong bimodal distribution to the data. Relationships were shown between transmissivity and dew point/absolute humidity that offered prediction of transmission to within 5 to 10 percent for rural (non-precipitating) aerosols. *Distribution authorized to U.S. government agencies and their contractors, critical technology, 18 August 1987. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801. WARNING--this document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, et seq) or the Export Administration Act of 1979, as amended (Title 50 U.S.C. App 2401, et seq). Violations of these export laws are subject to severe criminal penalties.*

USAFETAC/PR-88/001 (AD-B123412) *Wind/Pasquill Stability Simulation Model*, by Capt. Harold A. Elkins, May 1988, 21pp. Describes USAFETAC's Wind/Pasquill Stability Simulation Model, or DNYPSIM. Wind speed is modeled in its component form (u & v); clouds are modeled through mean cloud cover. The 4-D Sawtooth Wave Model is used to create equivalent normal deviates for u, v, and cloud cover. These are applied to climatological coefficients to give simulated values. Insolation is estimated using sun elevation angle and time of year. These inputs are used to create a Pasquill Stability Index. Output is given at each time step.

USAFETAC/PR-88/002 (AD-A202477) *Corrosion Control Climatology*, by SSgt. Debra L. Stoner, October 1988, 42pp. Provides tabular climatological data for 183 locations worldwide; prepared for an Air Force corrosion prevention and control contractor. Tables give mean number of days with temperature less than or equal to 40° F at noon local time, precipitation greater than a trace, temperature greater than 85° F for 5 hours or more, thunderstorms, relative humidity greater than 60 percent at noon local time, winds greater than 15 knots between 0006 and 1800L, and wind greater than 15 knots--all hours.

USAFETAC/PR-88/003 (AD-A203961) *Upper-Wind Climatology for CONUS*, by MSgt. Susan Reyes-Sauter, November 1988, 115pp. Report consists of 12 sets (one set for each month) of CONUS maps with upper wind speed/direction plots at every 5 degrees of latitude and longitude. Winds are plotted at nine levels, starting at 5,000 feet MSL and ending at 45,000 feet MSL.

Database used was the Air Force Global Weather Central's SADS (Summarized Analysis Data Set), period of record 1977-1982.

USAFETAC/PR-89/001 (AD-A209137) *European Crosswind Frequencies*, by TSgt. Gary H. Tryon, February 1989, 443pp. Documents the results of a study (for 2WW/DN) to determine percent occurrence frequency of crosswinds at 39 selected European bases. Provides "percent frequency of occurrence" tables for crosswinds greater than or equal to 10, 15, 20, and 25 knots under various weather conditions such as precipitation and below-freezing temperatures. Sixteen tables are provided for each base, and each set is allowed by a "number of actual cases" table. The study should help forecasters, planners, and engineers in estimating crosswind possibilities at various speed thresholds; should also help in estimating those possibilities during rain, snow, and below-freezing conditions.

USAFETAC/PR-89/002 (AD-A228604) *Microwave Propagation Study for the Florida Gulf coast*, by Capt. Charles T. Linn, March 1989, 317pp. Documents a 1980 USAFETAC study of atmospheric refractivity and its effects on microwave communications along the Gulf coast of Florida. The study involved 11 selected cases of both "good" and "bad" received signal levels (RSLs). The database incorporated weather sounding data from tethered balloons at Cape San Blas, White City, and Apalachicola, as well as surface weather observations from Apalachicola, Tyndall AFB, and Eglin AFB. Each case includes examples of RSL stripcharts, synoptic-scale weather maps, tables of surface weather observations, M-profile plots, and raytrace plots. General conclusions and suggested ways to solve propagation problems are included.

USAFETAC/PR-89/003 (AD-A210361) *Climatology Handbook for V Corps Forward Areas*, by SSgt. Dennis Murphy, April 1989, 119pp. Provides concise tabular climatology or certain weather conditions that affect tactical operations in V Corps forward areas of Germany. Operational categories include terrain flying, VFR helicopter flying, close air support, paradrops, chemical operations. Weather categories include visibility, ground observation, winds, snow depth, temperature, precipitation, light data. Printed in 5 x 8 1/2-inch format to fit BDU trouser pockets.

USAFETAC/PR-90/001 (AD-A243313) *Temperature Climatology for 160 Army Installations in the CONUS*

and Hawaii, by SSgt. Debra L. Runyon, June 1990, 69pp. Provides tabular temperature climatology for 160 Army Installations in the CONUS and Hawaii. Data was prepared for the Army Corps of Engineers for inclusion in a study of the feasibility of using coal as a primary heating fuel. Tables give the following for each location: Annual heating degree days: 99 and 97.5 percent winter design temperatures, mean annual temperature. Also given: Monthly heating degree days, mean temperatures, record low temperatures. All temperatures in degrees Fahrenheit.

USAFETAC/PR-90/002 (AD-A232993) *Temperature Climatology for 128 Navy Installations in the CONUS and Hawaii*, by SSgt. Debra L. Runyon, December 1990, 64pp. provides tabular temperature climatology for 128 Navy installations in the CONUS, Guam, Hawaii, and Puerto Rico. Data prepared for the Naval Energy and Environmental Support Activity for inclusion in a study of the feasibility of using coal as a primary heating fuel. Tables give the following for each location: annual heating degree days; 99 and 97.5 percent winter design temperatures; and mean annual temperature. Also given: monthly heating degree days, mean temperatures, and record low temperatures. All temperatures in degrees Fahrenheit.

USAFETAC/PR-90/003 (AD-B152198) *SAC Contrail Forecasting Algorithm Validation Study*, by Maj. Walter F. Miller, November 1990, 28pp. Documents results of a study to determine validity of a new RC-135 contrail validation algorithm (SACFCST) developed by 3WW/DNC. The study showed SACFCST to have almost the same skill as TROPFCST (an earlier AWS contrail algorithm) and the current AQFCWC contrail analysis. It also showed, however, that none of the methods studied were successful in forecasting when contrails would end if the aircraft maintained constant altitude. The PIREP database provided for this study was flawed in that nearly every observation included contrail reports; the result was gross over forecasting. The study concluded that a better database was needed--one that would provide systematic contrail observations along a specified flight path at 15- or 30-minute intervals. Even better would be one taken from actual aircraft soundings (surface to maximum service altitude) flown near a radiosonde launch site--the original AWS algorithm was developed from such a database.

USAFETAC/PR-90/004 (AD-A231925) *Griffiss AFB Lake Effect Snow Study*, by Capt. John D. DeBlock

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and William R. Schaub, Jr., December 1990, 18pp. Describes USAFETAC's effort in developing 11 new decision trees for forecasting lake-effect snow at Griffiss AFB, N.Y. To develop the new methods, USAFETAC modified a snow forecasting decision tree created by the National Weather Service Forecast Office (NWSFO) at Buffalo, N.Y., (Niziol, 1987). In addition to other changes, 10 of the 11 USAFETAC-developed trees were modified to use stability indices as input variables. All 12 trees were verified against a dependent period of record (1973 to 1986) and an independent period of record (1987 to 1988). Results showed that all 10 modified decision trees that used stability indices were effective in forecasting lake effect snow at Griffiss AFB, N.Y., with little statistical difference among them.

USAFETAC/PR-90/005 (AD-A231651) *Effective Sunspot Number (SSNi) Comparison Study*, by Capt. Mary L. Hart, December 1990, 39pp. Documents results of a study done to determine whether or not reliable global Effective Sunspot Numbers (SSNis) for the Air Force Global Weather Central's (AFGWC's) Ionospheric Conductivity and Electron Density (ICED) model could be calculated based on the present number (11) or digital ionosonde sites. The study found that increasing the number of sites would have a limited effect on ICED output, and that it was feasible to run the ICED model using the present 11-station network, subject to certain limitations.

USAFETAC/PR-90/006 (AD-A240489) *Short-Term Hourly Temperature Interpolation*, by Maj. Walter F. Miller, December 1990, 39pp. Describes the development of a computer method for interpolating missing hourly temperatures in weather observing records. Although a long-term interpolation method is under consideration, this report deals with replacing missing temperatures over periods of less than 6 consecutive hours.

USAFETAC/PR-90/007 (AD-A231715) *Range Reference Atmosphere, Wake Island*, November 1990, corrected and reissued January 1991, this range reference atmosphere (RRA) is a statistical model (derived from upper-air observations) of the atmosphere from 0 to 30 km over Wake Island. It provides tabulations of monthly and annual means, standard deviations, and skewness coefficients for wind speed, pressure, temperature, density, water-vapor pressure, virtual temperature, and dew-point temperature. It also gives means and standard deviation for the zonal and meridional wind components

and hydrostatic model atmosphere. Methodology is included, along with graphic displays of wind statistics that can be derived from the wind data.

USAFETAC/PR-90/008 (AD-A231926) *Range Reference Atmosphere, Nellis*, December 1990, 150pp. A statistical model (derived from upper-air observations) of the atmosphere from 0 to 30 km over the Nellis range complex. The data used to create this document was from Desert Rock (KDRA), about 50 NM west of Nellis AFB, Nev. The RRA provides tabulations of monthly and annual means, standard deviations, and skewness coefficients and wind speed, pressure, temperature, density, water-vapor pressure, virtual temperature, and dew-point temperature. It also gives means and standard deviation for the zonal and meridional wind components and hydrostatic model atmosphere. Methodology is included, along with graphic displays of wind statistics that can be derived from the wind data.

USAFETAC/PR-91/001 (AD-A233113) *Misawa Snow Accumulation Study*, by William R. Schaub, Jr., February 1991, 26pp. Describes the development of statistically significant thresholds of 11 atmospheric variables for forecasting snow at Misawa Air Base, Japan. The 11 variables were: gradient-level temperature and dew-point temperature, 850-mb temperature, 700-mb temperature, thicknesses for five layers between 1,000 feet AGL and 500 mb, gradient wind direction, and gradient wind speed. USAFETAC did simple correlations of each variable with observed 6-hour snowfall amounts to develop a linear regression equation that would predict 6-hourly snowfall amounts. Since the linear regression did not show skill, the study was expanded to develop a decision tree for making a "yes" or "no" snow determination. The new decision tree scored well using dependent data, but not very well on independent data (it lost to persistence). USAFETAC doesn't recommend either technique for use in forecasting, but suggests further development and evaluation of the decision use over a longer period of record.

USAFETAC/PR-91/002 (AD-A232775) *Minot AFB Wind Study*, by Maj. Walter F. Miller, January 1991, 52pp. Documents the development and evaluation of 11 algorithms for forecasting gusty northwest winds at Minot AFB, N.D. Six of the algorithms used pressure gradients between Dickinson, N.D., and Portage la Prairie, Canada, and between Glasgow, Mt., and Yorkton, Canada. The other five used the 850- or 700-mb wind

over Glasgow, MT. One of the algorithms was found to have skill in forecasting gusty winds and was recommended for operational use.

USAFETAC/PR-91/003 (AD-A232813) *Range Reference Atmosphere, Shemya*, January 1991, 164pp. A statistical model (derived from upper-air observations) of the atmosphere from 0 to 70 km over the Shemya range complex. The RRA provides tabulations of monthly and annual means, standard deviations, and skewness coefficients for wind speed, pressure, temperature, density, water-vapor pressure, virtual temperature, and dew-point temperature. It also gives means and standard deviation for the zonal and meridional wind components and hydrostatic model atmosphere. Methodology is included, along with graphic displays of wind statistics that can be derived from the wind data.

USAFETAC/PR-91/004 (AD-A232853) *A Smoothing Algorithm for Upper-Air Soundings*, by Capt. Gregory J. Reding, February 1991, 23pp. Describes the development of a filtering algorithm for smoothing vertical traces of temperature, pressure, and density through the atmosphere. An overlapping mean method employing an exponential weighting function was applied over several adjacent levels to calculate a smoothed value for the required point. The exponential function was chosen because it decreases symmetrically from a central value and easily incorporates a variable bandwidth; this lets users smooth profiles to the desired resolution. Upper-air data needs to be interpolated to evenly-spaced intervals in the vertical prior to program execution; if it is not, resulting profiles will not be hydrostatically consistent. Based on spectral analysis of samples from two test sites, no noise was introduced into the smoothed profiles.

USAFETAC/PR-91/005 (AD-B158050) *Caribbean Basin Radar Network Ray Trace Study*, by Michael F. Squires, June 1991, 11pp. This report documents a ray trace study of two Stations in the Caribbean Basin Radar Network (Santo Domingo, Dominican Republic, and San Andres Island, off the coast of Nicaragua). Ray trace calculations were done with the Engineer's Refractive Effects Prediction System (EREPS). The study failed to show why both radars experienced clutter during testing, but it did detect significant altitude error: i.e., large differences between the actual height of the radar beam and what it would be in the standard

atmosphere. *Note: Distribution authorized to U.S. government agencies and their contractors, software documentation, 31 January 1991. Other requests for this document shall be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801.*

USAFETAC/PR-91/006 (AD-A232831) *Range Reference Atmosphere, Thule*, February 1991, 178pp. A statistical model (derived from upper-air observations) of the atmosphere from 0 to 70 km over the Thule range complex. The RRA provides tabulations of monthly and annual means, standard deviations, and skewness coefficients for wind speed, pressure, temperature, density, water-vapor pressure, virtual temperature, and dew-point temperature. It also gives means and standard deviation for the zonal and meridional wind components and hydrostatic model atmosphere. Methodology is included, along with graphic displays of wind statistics that can be derived from the wind data.

USAFETAC/PR-91/007 (AD-A243314) *Range Reference Atmosphere, Fairbanks*, February 1991, 152pp. A statistical model (derived from upper-air observations) of the atmosphere from 0 to 30 km over the Fairbanks range complex. The RRA provides tabulations of monthly and annual means, standard deviations, and skewness coefficients and wind speed, pressure, temperature, density, water vapor pressure, virtual temperature, and dew-point temperature. It also gives means and standard deviation for the zonal and meridional wind components and hydrostatic model atmosphere. Methodology is included, along the graphic displays of wind statistics that can be derived from the wind data.

USAFETAC/PR--91/008 (AD-A240385) *Density Altitude Maps of Iran and Iraq*, by Maj. Walter F. Miller, May 1991, 54pp. This report provides maps of Iran and Iraq with contours of mean monthly density altitude at the surface near the times of maximum and minimum temperatures. Surface values of temperature, vapor pressure, and pressure used to calculate DA were adjusted at each grid point using girded terrain elevation from the Defense Mapping Agency (DMA) 100-meter Digital Terrain Database .

USAFETAC/PR--91/009 (AD-A240702) *Persian Gulf Contrail Algorithm Limits*, by Capt. Gregory J. Reding, June 1991, 51pp. Describes development of computer program (DNCONTRL) that determines the mean and

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extreme upper and lower limits for conditions that favor condensation trail formation over a given upper air reporting station. Output of the DNCONTRL program is provided in tabular form for 19 stations in the Persian Gulf region, not only as upper and lower altitudes for the formation of contrails, but as monthly percent occurrence frequency (POF) for favorable contrail formation at specified altitudes. These results were compared with an earlier, similar study, for the entire Northern Hemisphere and found to be consistent.

USAFETAC/PR--91/010 (AD-A240484) *Malmstrom AFB Chinook Wind Study*, by Capt. Gregory J. Reding, May 1991, 31pp. This report documents efforts to determine correlations among certain weather variables at Malmstrom AFB, Mont., in an attempt to help forecast the onset of winds over 75 knots during Chinook season (October through April). Only weak relationships could be found. Predictive equations based on these correlations were developed using linear regression techniques; the equations allowed limited skill. USAFETAC then tried to improve the Heidke skill scores by including more predictor variables chosen by a stepwise regression technique; skill scores improved slightly, but remained below 0.50. Finally, USAFETAC looked for a favored time interval between development of a 10-mb sea-level pressure difference and onset of 25-knot gusts or sustained winds at Malmstrom; there was none.

USAFETAC/PR--91/011 (AD-A240486) *C-29A Aircraft Altimeter Errors*, by William R. Schaub, Jr., June 1991, 39pp. This report documents the results of a study initiated to solve problems with pressure altimeter errors (differences between indicated and true altitude) aboard Air Force C-29A flight inspection aircraft. A basic review of altimetry is provided, along with an explanation of how atmospheric changes affect barometric pressure and pressure altimeters. A method for in-flight correction of altimeter errors is provided, along with an appendix that gives monthly error statistics for the three C-29A working flight levels (1,000, 1,500, and 2,000 feet above ground level). Although the results of this study are only applicable to Scott Air Force Base, Ill., they can be considered generally representative of other stations with similar field elevations in the midwestern United States. USAFETAC has the ability to produce climatological altimeter error data for any location from which representative upper-air and surface observations are available.

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USAFETAC/PR--91/012 (AD-A240456) *Groves Model Accuracy Study*, by Capt. Matthew C. Peterson, August 1991, 72pp. USAFETAC was tasked to review the scientific literature for studies of the Groves Neutral Density Climatology Model and compare the Groves Model with others in the 30-60 km range. The tasking included a request to investigate the merits of comparing accuracy of the Groves Model to rocketsonde data. USAFETAC analysts found the Groves Model to be state of the art for middle atmospheric climatological models. In reviewing previous comparisons with other models and with space shuttle-derived atmospheric densities, good density vs altitude agreement was found in almost all cases. A simple technique involving comparison of the model with range reference atmospheres was found to be the most economical way to compare the Groves Model with rocketsonde data; an example of this type of analysis is provided in the report.

USAFETAC/PR--91/013 (AD-A240458) *March AFB Forecasting Rules of Thumb Evaluation*, by Capt. Brian M. Bjornson, July 1991, 20pp. This report documents an evaluation of 23 different "rules of thumb" used in weather forecasting at March AFB, Calif. Surface and upper-air data was collected for selected cities in southern California and Nevada. Pressure differences, dew-point temperature, and 850-mb and 500-mb heights were calculated for the selected locations and used to predict ceiling and/or visibility, wind direction, or rain/drizzle events at March AFB. Predictor and predictand variables were identified. The procedure for determining the probability of the predicted variable, given the predictor, is described, and the accuracy and statistical significance of the results are tested statistically. Frequency distribution tables for each of the 23 rules-of-thumb are given in an appendix.

USAFETAC/PR--91/014 (AD-A242100) *Height-Error Analysis for the FAA-Air Force Replacement Radar Program (FARR)*, by Michael F. Squires, August 1991, 375pp. This report documents an evaluation of three methods for determining radar beam height at 40 proposed FAA and USAF radar stations. All three methods were compared to radiosonde observations (RAOBs), which are assumed to be ground truth, in order to determine height errors. The report concluded that climatology was superior to the triexponential model at 70 percent of the stations studied. Both climatology, and the triexponential model were found to be superior to the standard atmosphere.

USAFETAC/PR--91/015 (AD-A240459) *Zaragoza AB Fog Study*, by Charles R. Coffin and Capt. Anthony J. Warren, July 1991, 18pp. This report documents efforts to provide an objective technique for forecasting the onset of fog and visibilities below certain specific thresholds at Zaragoza AB, Spain. The study was in response to a problem with dense fog at Zaragoza. The report addresses the problem in two parts: first, with tables that identify the number of hourly observations of fog at Zaragoza, stratified by certain weather variables and second, with a fog forecasting model based on discriminant analysis that provides an estimated probability of a specified visibility threshold as a function of time.

USAFETAC/PR--91/016 (AD-A321156) *Spatial and Temporal Correlation of Surface Temperature and Wind Observations*, by Capt. Anthony J. Warren and Capt. John A. Rupp, November 1991, 144pp. Nearly all weather support products depend on the fundamental accuracy of the basic weather observation, and observational accuracy depends, at least in part, on frequency and spacing. In many parts of the world, surface observations are only taken at 3-hour intervals. Weather station spacing is irregular, and may exceed one station per 200 km. When a weather observation is needed at a specific time and place (as in climatological analysis), it is usually necessary to interpolate by using the data closest to that time from the nearest available weather station. There are errors inherent to this procedure, and users of such data normally require estimates of those errors. This study provides these error estimates as functions of time and distance for surface weather observations of temperature, wind speed, and wind direction. After the methodology is explained, results are provided in appendices as probability data in a series of charts that show percentiles of cumulative distribution of changes in temperature, wind speed, and wind direction as functions of distance or time.

USAFETAC/PR--91/017 (AD-A240394) *A Method for Estimating Missing Hourly Temperatures Using Daily Maximum and Minimum Temperatures*, by William R. Schaub, Jr., August 1991, 21pp. This report describes the development of a computer method for filling in missing hourly temperatures for locations that report only daily maximum and minimum temperatures. The "filling" technique is required to calculate cooling degree hours (CDH) for weather stations with incomplete temperature records.

USAFETAC/PR--91/018 (AD-A242186) *Optimal Placement of a GEODSS (Ground-Based Electrooptical Deep-Space Surveillance) Sensor*, by Capt. Anthony J. Warren, August 1991, 26pp. Successful operation of the Ground-Based Electrooptical Deep-Space Surveillance (GEODSS) system, basically an optical video camera that tracks objects in high Earth orbit, requires that the following five conditions are met: Sun at least 6 degrees below the horizon; surface wind speed less than 25 knots; temperature more than -50° C; satellite elevation at least 15 degrees above horizon; and a 5-minute cloud-free line-of-sight between satellite and sensor. This report gives the probabilities of combinations of those conditions at twelve proposed Canadian GEODSS sites. It includes a review of fundamentals, a discussion of computer model results, and a comparison of results for each candidate location.

USAFETAC/PR--91/019 (AD-A243315) *Comparison of Two Eighth-Mesh Terrain Databases*, by Capt. Richard B. Hartman, September 1991, 27pp. This report compares the accuracy of the new Phillips Laboratory Geophysics Directorate (GD) eighth-mesh terrain database with an older eighth-mesh terrain database developed and used by the Air Force Global Weather Central (AFGWC). Most of the eighth-mesh grid points laced over major land masses were examined by comparing the point values for each database with the elevation of nearby Air Weather Service Master Station Catalog (AWSMSC) stations. By subtracting the point values of each database from the AWSMSC, two sets of different values were created and summarized with the root mean square error (RMSE) and mean of the absolute error (AE). The comparison showed that there was little difference between databases in the Northern Hemisphere, but that the GD database was much better than the AFGWC database in the Southern Hemisphere.

USAFETAC/PR--91/020 (AD-A260175) *RTNEPH Total Cloud Cover Validation Study*, by Capt. Ronald P. Lowther, et al., October 1991, 51. In 1983, the Air Force Global Weather Central (AFGWC) implemented a new model to map and store an analysis of worldwide cloud-cover derived from surface and satellite data. This model, designated the Real-Time Nephanalysis (RTNEPH), contains analyses of total sky cover, cloud bases, and cloud heights. Studies assessing the accuracy of the RTNEPH database have, up to now, been limited. In this work, the RTNEPH total sky-cover database is evaluated against independent surface observations.

Since the RTNEPH algorithm heavily weights available surface observations, this was not a simple task: more than 500,000 independent surface and RTNEPH observations had to be matched and evaluated. Frequency distributions of the differences in these two sources were computed and stratified by latitude, season, time of day (day vs. night), and age. Finally, statistical tests were run to obtain quantitative assessments of the results. In general, the RTNEPH total sky cover compared favorably with surface reports, but there were differences. Certain biases in the RTNEPH were also identified, most notably the underestimation of cloud cover in arctic regions and the poor resolution of RTNEPH in regions where the airways surface observation code is used.

USAFETAC/PR--91/021 Not used.

USAFETAC/PR--91/022 (AD-A247246) *Simulated and Observed Sunny Line-of-Sight Data at Palehua, Hawaii*, by Capt. Anthony J. Warren, November 1991, 17pp. Documents a study of the differences in the climatological probabilities of a cloud-free line-of-sight (CFLOS) at the Palehua, Hawaii, Solar Optical Observatory and the Barbers Point Naval Air Station. The study shows that sunny line-of-sight (SLOS- cloud-free line-of-sight from an observer to the Sun) probabilities are typically about 10 percent lower at Palehua, (elevation about 1,700 feet) than at Barbers Point (34 feet). The study compared 17 years of actual weather observations from Barbers Point and 5 years of Palehua solar optical site status reports (surface weather observations are not available from Palehua). The results of the study suggest that the Stanford Research Institute technique for relating fractional sky-cover and viewing angle to CFLOS probability (described by Malick, et al, 1979) is valid for use in Hawaii.

USAFETAC/PR--91/023 (AD-A247545) *Wind-Speed Forecasting Study for Westover AFB, Massachusetts*, by William R. Schaub, Jr., December 1991, 34pp. Describes results of a wind-speed forecasting study for Westover AFB, located in the Connecticut River valley of western Massachusetts. The study was requested by the 21st Air Force Directorate of Weather to identify useful tools for forecasting wind speeds at Westover AFB. The results were five models that can be used as guides for forecasting maximum Westover wind speeds for 6-hour periods starting at any 3-hourly time (00Z, 03Z, etc.) in any season. Methodology is provided, along

with a description of input data, verification of the models, and final results.

USAFETAC/PR--91/024 (AD-A321154) *Optimal Placement of a GEODSS (Ground-Based Electrooptical Deep-Space Surveillance) Sensor, A Follow-on Report for 14 Candidate Sites Worldwide*, by Capt. Thomas H. Elio, November 1991, 22pp. A follow-on report to USAFETAC/PR--91/018, which provided site-specific data for 12 proposed Canadian Ground-Based Electrooptical Deep-Space Surveillance (GEODSS) stations. The follow-on provides much of the same general data, but with site-specific data for 13 different candidate GEODSS stations around the world. Successful operation of the system, basically an optical video camera that tracks objects in high Earth orbit, requires that the following five conditions are met: Sun at least 6 degrees below horizon; surface wind speed less than 25 knots; temperature more than -50° C; satellite elevation at least 15 degrees above horizon; and a 5-minute cloud-free line-of-sight between satellite and sensor. This follow on report gives the probabilities of combinations of those conditions at 14 proposed GEODSS sites; seven in Australia, four in Indonesia, and one each in Italy, the Philippines, and the Netherlands Antilles. It includes a review of fundamentals, a discussion of computer model results, and a comparison of results for each candidate location.

USAFETAC/PR-92/001 (AD-A254182) *Wind-Speed Periodicity Study for Shemya AFB, Alaska*, by Capt. Christopher A. Donahue, April 1992, 20pp. Describes results of a time-series analysis that attempts to identify high frequency periodicities (fluctuations with periods of less than 1 hour) in wind speed at Shemya AFB, Alaska. Peaks in the power spectra at low frequencies were filtered out, and the remaining peaks were tested for significance. None of the peaks in the spectra at high frequencies were found to be significantly different from white noise.

USAFETAC/PR-92/002 (AD-A269339) *DTED (Digital Terrain Elevation Data) Study*, by Capt. Donald R. Johnson, June 1992, 27pp. Terrain height errors have significant effects on studies sensitive to atmospheric quantity and structure, such as USAFETAC's atmospheric profiles (point analyses). A recent study concluded that the primary source of degradation in atmospheric profile quality was caused by the coarse grid spacing of the eighth-mesh data used in the Air Force Global Weather Central (AFCWC) Atmospheric Slant Path Analysis Model (ASPAM). This report

documents a study that determines the feasibility of incorporating the Defense Mapping Agency (DMA) high density Digital Terrain Elevation Data (DTED) into the AFGWC atmospheric profile model. The report also describes a procedure, developed by USAFETAC, to make the dataset smaller and save computer storage space.

USAFETAC/PR-92/003 (AD-A254410) *SAC Contrail Formation Study*, by Capt. Brian M. Bjornson, May 1992, 48pp. This report documents the results of a study that compares the Appleman contrail forecasting method used at the Air Force Global Weather Central (AFGWC) with the SAC method using pilot report (PIREP) data collected by SAC/DOW between March 1990 and July 1991. The study resulted in development of two other contrail forecasting techniques. The first (ETACFCST) was developed using discriminant analysis schemes to obtain "best fit" curves of contrail formation as a function of altitude and temperature, or altitude, temperature, and vertical motion. Statistics showed ETACFCST to be better than either the Appleman or SAC contrail prediction curves. But another technique developed near the end of the study incorporated aircraft engine type as a factor for the first time. The new engine-specific contrail forecasting technique is recommended as a replacement for the Appleman method used at AFGWC.

USAFETAC/PR-92/004 (AD-A258065) *Cloud Model Database Comparison Study*, by Capt. Kirk D. Poore, August 1992, 55pp. This report documents the results of a study that examines and compares the Air Force Global Weather Central's (AFGWC's) climatological cloud model databases: Real-Time Nephanalysis (RTNEPH) and Three-Dimensional Nephanalysis (3DNEPH). The study investigated their characteristics, determined the length of a climatologically sound period of record (POR), found a year with "typical" cloud cover for use as a baseline in future studies, and weighted the advantages and disadvantages of Multipurpose Simulator (MPS) databases derived from the RTNEPH and 3DNEPH. The older 3DNEPH cloud model, first used in the 1980s, produced worldwide, layered cloud analyses on a 25-NM grid. The RTNEPH replaced 3DNEPH at the beginning of 1984.

USAFETAC/PR-92/005 (AD-A260288) *ASPAM (Atmospheric Slant Path Analysis Model) Statistical Paired Differences Study for Sample Size Determination*, by Capt. Thomas H. Elio, Charles R.

Coffin, and Maj. Lauraleen O'Connor, November 1992, 42pp. Describes methodology and results of a pilot study intended to determine the required sample size for a statistically significant seasonal study of the differences between ground truth (represented by upper-air soundings) and (1) ASPAM optimum interpolation vertical profiles (OIVPs) and (2) alternate vertical profiles. This study builds on earlier ASPAM studies, incorporating lessons learned and user feedback. It found that a sample size of 50 observations was enough to determine if the differences between ground truth (upper-air soundings) and ASPAM vertical profiles were significant at the customer's confidence level.

USAFETAC/PR-92/006 (AD-A263156) *LIGHTPC Accuracy Study*, by Capt. Matthew C. Peterson, December 1992, 49pp. This report documents the results of a USAFETAC study of the accuracy of LIGHTPC and ICE PC small computer programs, both of which were used to compute astronomical data such as sunrise, sunset, moonrise, and moonset. It presents error distributions for programs at and above 60 degrees north. The report discusses weaknesses of the LIGHTPC program and errors in the ICE program. A technique for using LIGHTPC to correct ICE to produce better twilight end times than by using ICE alone is provided.

USAFETAC/PR-92/007 (AD-A261381) *BitHit/Solar Activity Correlation Study*, by Capt. Mary L. Hart, December 1992, 36pp. This report documents a study of statistical correlations between Global Positioning Systems (GPS) satellite anomalies ("bit hits") and the state of the actual space environment from 1 October 1984 through 31 March 1991. The study compared distributions of space environmental data with GPS anomalies to determine the correlations (if any) of GPS anomaly occurrences with space environment variables such as global geomagnetic index and proton/electron counts. Using stepwise linear regression and discriminant analysis, correlations were found to be very low. Regression equations were found to predict the probability of satellite anomalies only slightly better than random chance.

USAFETAC/PR-93/001 (AD-A269401) *Thunderstorm Forecast Study for Eglin AFB, Florida*, by Capt. Daniel Cornell, March 1993, 48pp. This report describes the evaluation of an empirical technique (WINNDEX) for predicting air-mass thunderstorms at Eglin AFB, Fla. Results showed that the WINNDEX objective forecast technique had a Heidke skill score of

.18 in predicting thunderstorm activity on the Eglin Range complex. A discriminant analysis model was developed that improved this skill to .32 in predicting the occurrence of thunderstorms during four 3-hour periods beginning at 1200Z. The study demonstrated the utility of USAFETAC's lightning database in developing and verifying a thunderstorm forecast model for remote locations.

USAFETAC/PR-93/002 (AD-A271102) *An Analysis of Cloud-Cover Reporting in the 1977 Surface Observation Database*, by 1st Lt. James G. Saccomando, Jr., September 1993, 14pp. The study examines cloud-cover report quality, coverage, and frequency around the world during 1977. The results of the analysis are plotted on global maps.

USAFETAC/PR-93/003 (AD-A271111) *Worldwide Frequency of Temperatures at Selected Altitudes*, by 1st Lt. James G. Saccomando, Jr., September 1993, 14pp. The study examines the surface weather observation database to determine cloud-cover report quality, coverage, and frequency around the world during 1977. The results of the analysis are plotted on global maps.

USAFETAC/PR-93/004 (AD-A269403) *"Cloudiest Year" Study-An Analysis of the 3DNEPH and RTNEPH Databases*, by Billy D. Bainter, April 1993, 25pp. Describes techniques used to analyze total cloud cover values from the USAF Environmental Technical Applications Center's Nephanalysis databases: 3DNEPH and RTNEPH. Object of the study was to determine if total cloud cover differed significantly on a year-to-year basis. Contoured global maps in an appendix show the results.

USAFETAC/PR-93/005 (AD-A286832) *Computing Optimum Heights for Balloon-Borne Radar*, by Michael F. Squires, November 1993, 18pp. The Air Defense Initiative is considering the use of balloon-borne radar transmitters. Tethering these balloons at an optimum height based on the effects of atmospheric refraction maximizes target detection efficiency. This report provides information for determining those optimum tethering heights. The data is provided on one 5 1/4-inch diskette (included) as tables of radar detection

data stratified by transmitter and target heights. Tables are accessible through a user-friendly interactive PC program that displays the data. Instructions for access to and interpretation of the tables included. Report summarizes assumptions, data, and methods used to create tables.

USAFETAC/PR-93/006 (AD-A277884) *Upper-Air Quality Control, A Comparison Study*, by Capt. David J. Speltz, November 1993, 30pp. Compares the upper-air quality control (QC) and data correction methods used by the Air Force Global Weather Central (AFGWC) and the National Meteorological Center (NMC). AFGWC uses the New Upper-Air Validator (NUAV), while NMC uses the Complex QC procedure for rawinsonde heights and temperatures (CQCHT). The study identifies advantages, disadvantages, and added value of both correction schemes.

USAFETAC/PR-94/001 (AD-B183617) *ASPAM (Atmospheric Slant-Path Analysis Model) Baseline Study*, by Maj. Lauraleen O'Connor and Charles R. Coffin, January 1994, 141pp. Compares temperature and humidity profiles from the Atmospheric Slant-Path Analysis Model (ASPAM) with independent ground-truth radiosonde data in three worldwide regions for four seasons. Ground-truth radiosonde observations (RAOBs) from 17 randomly chosen sites were denied to the ASPAM optimum interpolation (OI), including the first-guess provided by the high-resolution analysis Model (HIRAS) model run at the Air Force Global Weather Central (AFGWC). Using all other available RAOB, surface, and satellite sounding data, the ASPAM OI produced vertical profiles (OIVP) of temperature and absolute humidity for comparisons with ground-truth vertical profiles (GTVP). Alternate vertical profiles (ALTVP), being the OIVP plus or minus a model estimate of one standard deviation for temperature or absolute humidity, were also compared to the GTVP and OIVP, respectively. The mean and standard deviations of the OIVP agreed well with expectations based on OI theory and the seasonal behavior of the ground-truth data. *Distribution authorized to the Department of Defense and DoD contractors, administrative or operational use, 5 February 1993. Other requests shall be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801.*

6.2 AFGWC PROJECT REPORTS. Refer requests to AFWTL, 151 Patton Ave., Asheville NC 28801, DSN 673-9019.

AFGWC/PR-82/001 (AD-None) *An Integrated Data Base Model Using Graphic Vectors*, by James L. Hatch, April 1982, 48pp. Tells how to build an integrated data base and products by using graphic vector manipulation. No attempt made to design a total system; basic concepts of graphic vector operations presented to Satisfy problems of data storage and management for a data base supporting an interactive meteorological display system.

AFCWC/PR-82/002 (AD-None) *AWS vs NWS CONUS MOS Test*, by Stephen P. Pryor, June 1982, 21pp. Describes a comparison of ceiling and visibility forecasts generated by the AWS Model Output Statistics system with similar forecasts produced by the National Weather Service. Forecasts for 21 stations in NE United States used in test. AWS system showed overall skill when forecasts measured against persistence Forecasts and climatology, but in general did not perform as well as the NWS system.

AFGWC/PR-83/001 (AD-A139129) *Air Weather Service Model Output Statistics System*, by Donald L.

Best and Stephen P. Pryor, October 1983, 89pp. Describes development and operation of AWS Model Output Statistics (MOS) system. Provides short history of migration of MOS technology and software from National Weather Service Technique Development Laboratory (TDL) to AFGWC.

AFGWC/PR-84/001 (AD-A144853) *Automated Aircraft Icing Forecast Techniques Project Report*, by M. Vance Mansur, 31 May 1984, 73pp. Provides a comprehensive overview of state of the art in icing forecasting and associated problems. Describes an attempt to automate a manual icing forecast technique; discusses weaknesses, software design, and algorithms. Attempts to filter out excess areal coverage, as produced by other automated procedures, were unsuccessful. Moderating the filtering resulted in a sieve effect with no better results than forecasts already produced by other automated methods. Final examination revealed other reasons for poor performance in automated mode. Manual technique has advantage of human pattern recognition vastly superior to coarse mesh grid data used in this study, as well as access to frontal positions. Some valuable lessons learned regarding theoretical limitations to skill scores and inherent limitations of the models.

Catalog of Air Force Weather Technical Documents

Chapter 6

AFCCC CLIMATIC DATABASE USERS HANDBOOKS

These handbooks provide potential users of selected AFCCC climatic databases with descriptions of those databases and information on how to obtain and use them. AFCCC/TN-96/001 is a directory of all AFCCC databases. Order these handbooks from the AFWTL, 151 Patton Ave., Asheville NC 28801-5002 DSN 673-9019.

USAFETAC/UH-86/001 (AD-A321333) *RTNEPH, USAFETAC Climatic Database Users Handbook No. 1*, September 1986, 18pp. Describes the Real-Time Nephanalysis database. Note: Revised November 1996.

USAFEETAC/UH-86/002 (AD-B108864) *Surface Temperature Analysis, USAFETAC Climatic Database Users Handbook No. 2*, October 1986, 17pp. Describes the eighth-mesh surface temperature analysis database.

USAFETAC/UH-86/003 (AD-B106038) *SESS, USAFETAC Climatic Database Users Handbook No. 3*, August 1986, 83pp. Describes the Space Environmental Support System (SESS) Climatic Database.

USAFETAC/UH-86/004 (AD-B108865) *DATSAV2 Surface, USAFETAC Climatic Database Users Handbook No. 4*, November 1986. Current reprint incorporates February 1987 errata, November 1988 Change 1.

USAFETAC/UH-88/001 (AD-A233023) *HIRAS, USAFETAC Climatic Database Handbook No. 5*, Revised February 1991. Describes the High Resolution Analysis System (HIRAS) Climatic Database.

USAFETAC/UH-93/001 (AD-A269402) *AWSMSC (Air Weather Service Master Station Catalog) USAFETAC Climatic Database Users Handbook No. 6*, March 1993.

AFCCC/UH-96/001 (AD-A304705) *DATSAV 2 Upper-Air Database User's Handbook*, February 1996, 61 pp. By Melvin I. Smith. Provides users of upper-air data with a description of the DATSAV2 format of the meteorological data as it's stored at OL-A, AFCCC.

AFCCC/UH-96/002 (AD-A305453) *Atmospheric Slant-Path Analysis Model (ASPAM) Quick Reference Users Handbook*, February 1996, 20 pp. By TSgt. Joan

K. Bergmann, TSgt. Cathrine Bird, TSgt. Heidi Tryon. Provides a quick reference for reading ASPAM point analysis products. Provides format and definitions for paragraph outputs and examples of output data for each paragraph included in point analysis products.

AFCCC/UH-96/003 (AD-B207995) *Atmospheric Slant-Path Analysis Model (ASPAM) Held Output Users Handbook*, March 1996, 88 pp. By Diane P. Johnson. AFWA and AFCCC use the Atmospheric Slant Path Analysis Model (ASPAM) to provide vertical profiles of meteorological data to numerous military and government customers. This guide details how the computer model uses held output data to produce a point analysis. *Distribution limited to U.S. government agencies and their contractors. Other requests must be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801.*

AFCCC/UH-96/004 (AD-A307851) *Satellite Derived Vertical Moisture Database Users Handbook*, March 1996, 14 pp. By Thomas H. Elio, and Patrick Giese. Provides users of upper-air moisture data with a description of the sensor derived moisture obtained from Special Sensor Microwave/Temperature (SSM/T-1 and SSM/T-2), Special Sensor Microwave, Imagery (SSM/I), and Vertical Temperature Profile (VTPR) sensors on DMSP and NOAA satellites.

AFCCC/UH-96/005 (AD-B208028) *Climatology of Cloud Statistics Users Handbook*, February 1996, 16pp. By Capt. Fred P. Lewis. Climatology of Cloud Statistics, an global cloud-cover database that supplies a broad spectrum of sky cover related statistics, is available in two forms: FORTRAN and QuickBasic. This users guide illustrates use of the FORTRAN version. *Distribution limited to U.S. government agencies and their contractors. Other requests must be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801-5002*

MICROCOMPUTER PROGRAMS

9.1 MICROCOMPUTER PROGRAMS. Order programs by number and title from AFWTL, 151 Patton Ave. Room 120, Asheville NC 28801-5002 DSN 673-9019. Note special instructions for limited distribution programs. NOTE: Many of these programs are DOS-based and/or not Y2K compliant. Before ordering inquire about the currency of the particular program.

PC-0027B AFTOX—Air Force Chemical Dispersion Model (Version 4.1), by AFGL/LYA, October 1989. Same as PC-0027A, but for Z-248, Z-150, and Z-180 and other EGA-equipped or CGA-equipped true IBM PC-compatibles. Computes hazard distances resulting from toxic chemical releases. Handles instantaneous or continuous gas or liquid releases from ground or elevated sources. Can also handle heated sources, such as plumes from smokestacks. Users enter appropriate meteorological and source data when prompted. Output is a contoured plot of specified concentrations, concentration at a specified point, and/or the location and value of the maximum concentration.

PC-0043 REFRACT (Version 1.0). Specify PC-0043A for VGA, PC-0043B for EGA. Refractivity climatology that gives vertical profile or refractivity (N-units), refractivity gradient profile (dNdH), and percent frequency of occurrence of anomalous propagation (AP—ducting, superrefraction, and subrefraction). Also displays monthly plots of AP for selected stations and hours. Data for each of the following blocks is provided on the AFCCC web site. Order REFRACT datasets by WMO block required from the following list:

- 01 Norway
- 04 Iceland, Greenland
- 07 France
- 10 West Germany
- 17 Turkey, Cyprus
- 40 Afghanistan, Jordan, Israel, Kuwait, Saudi, Arabia, Syria
- 41 Bangladesh, Pakistan, Saudi Arabia
- 62 Egypt, Libya
- 63 Ethiopia, Kenya, the Seychelles
- 70 Alaska
- 72/74 CONUS
- 76 Mexico
- 78 Central America, Caribbean Basin
- 80 Colombia, Venezuela
- 81 French Guiana

PC-0046D NITELITE for Windows Version 5.01A. Nitelite (Nighttime Light Data Program) generates daily solar and lunar event times for graphical and tabular display. Nitelite also calculates lunar and solar illumination quantities for NVG applications, again with a tabular or graphical display option. Nitelite includes an algorithm to compute solar and lunar data for any year through 2005. Increased computational accuracy and inclusion of more details of the astronomical calculation allow the SLAC code to produce more accurate results for a much longer period and to compute more accurate results for higher latitudes (up to 75 degrees North or South). Also, this version gives the user a choice for civil, nautical, or astronomical twilight. Finally, dates for NVG illumination graphics are more explicitly labeled for ease of reference. This version includes saving default inputs, saving and recalling data files for various locations, upgraded print capabilities, and night vision goggle planning data. ***Distribution is limited to DOD and DOD contractors only: Administrative or Operational, April 1998. Requests for this program will be referred to AFCCC/DOO, 151 Patton Ave, Rm 120, Asheville NC 28801-5002.***

PC-0046E. NITELITE for Windows Version 5.01A. (16 Bit) See PC-0046D for description.

PC-0050 Electrooptical Climatology (EOCLIMO) for Windows, Version 1.1. This interactive computer program allows users access to a comprehensive electrooptical climatological dataset for selected stations worldwide. There were no changes to any algorithms or calculations of the EOCLIMO data. Regional maps were updated to reflect current political boundaries. The program produces graphs of EO-related conventional climatological data (ceilings, precipitation, and fog) as well as atmospheric transmittance climatology. EO data for the 8-12 micron band is computed by the LOWTRAN7 model using a standard geometry of 125-meter (410-foot) AGL sensor height and 4-km (2.16-NM) slant range with an assumed cloud-free line-of-

sight. System requirements and installation instructions are detailed in the README.WRI file on disk 1. The following EOCLIMO datasets are available:

<i>Region</i>	<i>Diskettes</i>
Southwestern Africa	4
Southern Africa	4
Southwestern Africa/Northeast Africa	4
Latin America	6
Pacific	11
Europe I (AL, BU, CZ, EG, HU, RO, IR)	13
Europe II (DN, FN, GR, NL, PL, SW, BE, CY, LI, SZ, FR, DL)	13
Europe III (DL, NL, SZ, SP, AU, IT)	13
Former Soviet Union	45
China/Mongolia	16
Range 1, Range 2	2

EOCLIMO version 1.0 data files are **NOT** compatible with version 2.0/2.1 software. *Distribution limited to DoD components only, critical technology, 27 September 1991. Other requests shall be referred to AFCCC/DOO, 151 Patton Ave, Rm 120, Asheville NC 28801-5002*

PC-0052 Discontinued—no longer available.

PC-0054 Discontinued—no longer available.

PC-0055 Upper-Air Climatology (UACLIMO), Version 2.0 (DOS version). Produced by USAFETAC, UACLIMO produces climatology for enroute flight planning (legs or points). Data available includes mean monthly winds, temperature, and D-value for the northern hemisphere. Also available: wind factors and monthly contrail probabilities. Each data point corresponds to a 2.5 by 2.5 degree grid location. There are 12 data files, one for each month. UACLIMO displays vertical profiles of pressure, height, temperature, D-value, wind speed, wind direction, and wind factor from surface to 100 mb. The program interpolates data for aircraft altitude, then places the aircraft data relative to mandatory pressure levels. For points, sounding information is modified to display surface data (including elevation and altitude variation). Contrail formation probabilities depend on flight level and aircraft/engine type. Users can choose from four aircraft/engine types (U-2 non-bypass, B-52 and KC-135A non-bypass, low-bypass, and KC-135R high-bypass).

PC-0055A Upper-Air Climatology (UACLIMO), Version 2.0 (Windows version). Produced by USAFETAC.

The Windows version of UACLIMO offers all the features and capabilities of the DOS version (PC-0055) while adding a Skew T capability and additional wind analysis displays. The Windows version also provides a more accurate flight-route calculation that uses an algorithm to determine a Great Circle route. An outline Help file provides better instructions for displaying data.

PC-0056 NATIONWIDE Lightning Climatology, Version 1.0. Produced by USAFETAC; displays cloud-to-ground (CG) lightning strike climatology for the United States. The climatology was developed from a commercial database consisting of 5 years (1986-1990) of March-October CG lightning data obtained from GeoMet Data Services, Inc. Using AFGWC's Northern Hemisphere Whole-Mesh Polar Stereographic Reference Grid, each CG lightning observation was assigned to a grid box; the average hourly number of lightning strikes was calculated for each grid box by month. Summarized data is displayed for each of eight regions. Graphs show diurnal variations of average hourly lightning strikes for any month or combination of months. Isopleth analyses give average hourly number of lightning strikes for any combination of months and hours. Tables give average hourly strikes by hour and month. Requires IBM-compatible (at least 286) PC with 640K main memory, MS-DOS 3.2 or later, and EGA or better graphics; 3.8MB hard-disk space is required. It will *not* operate from floppy drives and it is *not* validated to run under Windows.

PC-0057 CLOUDS (Climatology of Cloud Statistics), Version 1.0. Produced by USAFETAC. Generates climatological cloud statistics in several formats. Although statistics represent average conditions, the program also generates the expected error based on natural variability and observing/archiving error. Statistics are generated from a highly compacted cloud database using both surface and satellite observations. The data can be presented in four ways: as single numerical values, as contoured maps, as graphs, or as histograms. Users can select from four groups of cloud statistics: sky cover (looking up); cloud-free line-of-sight or cloudy line-of-sight (looking up or down); satellite-based viewing (looking down); or database statistics. Hardware requirements: IBM-compatible 286 or better with 640-KB main memory, MS-DOS 3.2 or later, EGA or better graphics, Epson-compatible dot matrix or HP LaserJet printer, and 1.2MB hard-drive storage (CLOUDS will run from floppies). CLOUDS is very memory intensive; it needs at least 600-KB to run effectively. It is not validated to run under Windows. *Distribution limited to U.S. Gov-*

ernment agencies and private individuals eligible to obtain export-controlled technical data IAW regulations implementing 10 U.S.C. 140c, 1994; other requests must be referred to AFCCC/DOO, 151 Patton Ave., Asheville NC 28801.

PC-0061 INSOL, Version 1.0. INSOL calculates accumulated solar insolation at the surface and top of the atmosphere from time, location, and weather inputs. Accumulated values are produced at 15-minute intervals in calories-per-square centimeter. INSOL also produces solar elevation angles (in degrees) for each 15-minute interval.

PC-0065 MODCURVES for Windows, Version 1.0, Modeled Diurnal/Annual Curves (MODCURVES) displays the diurnal or annual changes of the following weather variables: temperature, dew point, relative humidity, altimeter, and pressure altitude. Requires an IBM-compatible 386 or better personal computer with 2MB of memory, MS DOS Version 3.2 or later, Microsoft Windows 3.1 or later, VGA or better graphics and 1.2MB of hard disk space.

PC-0066 MODCV for Windows, Version 1.1, Modeled Ceiling and Visibility (MODCV) is an interactive program that calculates and displays the conditional and unconditional probabilities of category values of ceiling, visibility, and joint ceiling and visibility. The program uses station specific coefficients to initialize Weibull and Reverse Weibull curves that model the cumulative distributions of ceiling and visibility. Serial correlation is used in conjunction with the modeled distributions to calculate the probability of occurrence for different user defined categories.

PC-0068 Nearest Station Utility, Version 1.0. The Nearest Station Utility allows the user to see where the stations are when deciding to use the station's climatological data. The user can select any point in the world by clicking or by entering a known latitude and longitude. Also, a search utility allows the user to go to a particular station. A regional map (16 x 16 degrees) is displayed with all stations plotted based on the information from the AWS Master Station Catalog (AWSMSC). The user's selected location is displayed adjacent to the cursor location in the upper right and

with a large red X on the map. The station information, the station's name, WMO number, elevation (feet or meters), and location in latitude and longitude is displayed by clicking on the plotted points. The station's position relative to the selected location is also displayed in miles and by direction.

PC-0070 Observer Assistant, Version 2.0. This program is a compilation of utilities that determine weather parameters such as wind chill, relative humidity, pressure altitude, cross wind components, etc. It also contains two hypertext help files to assist with taking and encoding weather observations. One of the help files (Cloud.hlp) contains PowerPoint examples of the 27 cloud types, which run automatically from within the program. The resolution of the user's monitor and video driver determines the clarity of these images. The other help file (Obsguide.hlp) is a complete training reference for encoding observations. The former HQ AWS/XON designed the program to be used on the job or for training.

PC-0072 Site Specific Upper-Air Climatology (SSUAC), SSUAC is a Windows-based program designed to produce displays of several climatological variables including the following: vertical atmospheric soundings (Skew-T and Log P); percent frequency of occurrence of wind directions for most mandatory levels; maximum and minimum values for temperature, dew point, relative and absolute humidity, density, and wind speeds for several levels. The program also outputs percentile graphs and mean deviation displays. Data to run the program must be requested separately from AFCCC/DOO or users may go to the Special Assistance Request page on the AFCCC web site (<http://thunder.safb.af.mil>) and request the site(s) required. NOTE: Since data must be converted and run through a statistical program to produce the final data sets, users should allow about a month for the data request to be fulfilled. System Requirements: IBM or compatible, 386 or better personal computer with 4MB of memory; Microsoft 3.1 or later; VGA or better graphics; 2MB of hard disk space (or more depending on number of sites required). Data resides in three files: *.cmb, *.pmb and *.id. Users need all three files for each site required to operate the SSUAC program.

9.2 CD-ROM Microcomputer Programs. The following microcomputer programs are available in CD-ROM format. Like the microcomputer programs previously listed, order these CD-ROM products from the AFWTL, 151 Patton Ave., Asheville NC 28801-5002. Note: Some of these programs are DOS based and/or not Y2K compliant. Before ordering inquire about the currency of the particular program.

CD-0001 *International Station Meteorological Climate Summary (ISMCS) Version 2.0.* A joint Navy/NOAA/USAFETAC project, on one CD-ROM disc. ISMCS includes summary data for 640 stations taken from Navy PC-SMOS, USAFETAC SOCS, and Navy Worldwide Airfield Summaries. User can print from disc and write selected data to an ASCII file for reformatting in a word processor. System requirements and start-up instructions are on the back of each disc. Previously named PC-0041.

CD-0002 *Marine Climatic Atlas of the World, Version 1.0.* This CD-ROM disc contains climatological information for user-specified geographical areas. Data consists of summarized marine climatology elements for 1- and 5- degree latitude/longitude squares. Displays are as tables or isopleths. System requirements and start-up instructions are on the back cover of the box. This version allows users to write tables to allow for loading tables into a word processor for reformatting. Formerly PC-0051

CD-0003 *Global Upper Air Climatic Atlas (GUACA), Version 1.0,* April 1993. This CD-ROM contains Volume I (period of record 1980-1987) and Volume II (period of record 1985-1991). System requirements and start-up instructions for this CD-ROM program are printed on the back cover of the box. This version lets users write tables to an ASCII file on the user's hard drive. The file contains displayed headers as well as the data within the table to allow loading tables into a word processor for reformatting. Formerly PC-0053.

CD-0004 *Global Tropical/Extratropical Cyclone Climatic Atlas, Version 2.0,* March 1994. This CD-ROM is a joint production of the National Climatic Data Center and the U.S. Navy. A single disc contains all historical tropical storm-track data available for five tropical storm basins. Periods of record (PORs) vary; some start as early as the 1870s and all run to the end of 1992. Northern hemisphere extratropical storm track data is included, with a 1965-1992 POR. Tropical track data includes time, position, and storm stage; maximum wind and central pressure is included when available. Users can display tracks and track data for any basin or geographical area they select. Narratives for tropical storms in the 1980-1992 period are included, as well as

basin-wide tropical storm climatological statistics. Formerly PC-0058.

CD-0005 *Global Historical Fields (GHF), Version 1.0.* This CD-ROM (produced by FNMOD, Asheville, N.C.) provides displays of daily synoptic weather maps from the past. Contains about 611MB of grid field information compressed from 2.1GB of data. GHF operates on IBM-compatible 286 or faster and CD-ROM reader compatible with ISO 9660 format. MS-DOS 3.1 or better is required. Program requires 400K of RAM and a hard or floppy drive for file creation. A mouse, if used, must be MS-compatible. Analyses are based on the Northern Hemispheric surface map series from 1899 to the mid-sixties and on gridded analyses from the mid-sixties through April 1994; for most of the period, only one map a day is available, but two a day become available in the data from the mid-sixties. The 700- and 300-mb levels are also available. For more information, see "Weather Maps in Motion," by LCDR Dennis Ruth, *Naval Meteorology and Oceanography Command News*, October 1994. Formerly PC-0059

CD-0006 *Cloud Ceiling Climatology Atlas (CCCA), Version 1.0.* This two-disc CD-ROM package (produced by USAFETAC) provides an interactive routine that displays cloud ceiling climatologies around the world. Color displays are provided for eight ceiling height categories annually or by month, for four Zulu times. All ceiling heights are above mean sea level. The first disc covers North America, Europe, the former USSR, China, and Mongolia; the second, Latin America, Africa, Southern Asia, and Australia/New Zealand. Users can animate displays by selecting annual, diurnal, or ceiling height category. Displays were generated from Real-Time Nephanalysis (RTNEPH) data using a 10-year period of record (1984-1993). System Requirements: 386 or better with at least 8MB of RAM, MS-DOS 3.21 or higher, MS Windows 3.1 or better, Super VGA, 1024x768 with 256 color. Start-up and installation instructions are on the back cover. Documentation is included on both discs. Formerly PC-0060.

CD-0007 *EOCLIMO.* The CD-ROM version 1.0 of PC-0050A/B, EO-CLIMO is now available. This CD contains the entire database and can be used in place of the 120-plus diskettes of PC-0050A/B. No changes have

been made to the program or data base. This CD gives access to a comprehensive electrooptical climatology dataset, for selected stations worldwide, rather than regions. Graphs provide monthly conventional and atmospheric transmittance climatology at 3-hourly intervals. Data for the 8-12 micron band are computer by LOWTRAN7. System requirements and start-up instructions are on the cover.

CD-0008 Theater Climatic File, Volume 1—Eastern Europe. Provides the user a variety of AFCCC climatological products on compact disk, tailored specifically for the Eastern Europe theater. Products include the following: Electrooptical Climatology (EOCLIMO, PC-0050); Cloud Ceiling Climatology (CCLIMO, PC-0060); Upper-Air Climatology (UACLIMO, PC-0055A); Modeled Ceiling/Visibility (MODCV, PC-0032); Modeled Diurnal/Annual Curves (MODCURVE); Nighttime Light Data (NITELITE, PC-0046A); Operational Climatic Data Summaries (OCDS) for selected locations in the Eastern Europe theater; and a hypertext version of USAFETAC/TN-93/004, *Eastern Europe: A Climatological Study*. User is guided among the various products via a graphic user interface. Requires Microsoft Windows Version 3.1; a Pentium processor is recommended.

CD-0009 Theater Climatic File, Volume 2—Swanea, November 1997. Provides the user a variety of AFCCC climatological products on compact disk, tailored specifically for Southwest Asia and Northeast Africa. Products include the following: Electrooptical Climatology (EOCLIMO, PC-0050); Cloud Ceiling Climatology (CCLIMO, PC-0060); Upper-Air Climatology (UACLIMO, PC-0055A); Modeled Ceiling/Visibility (MODCV, PC-0032); Modeled Diurnal/Annual Curves (MODCURVE); Nighttime Light Data (NITELITE, PC-0046A); Operational Climatic Data Summaries (OCDS) for selected locations in the SWANEA theater; and a hypertext version of USAFETAC/TN-91/002, *The Middle East Peninsula: A Climatological Study*. User is guided among the various products via a graphic user interface. Requires Microsoft Windows Version 3.1; a Pentium processor is recommended.

CD-00010 Theater Climatic File, Volume 3—Equatorial Africa, July 1997. Provides the user a variety of AFCCC climatological products on compact disk, tailored specifically for Equatorial Africa. Products include the following: Electrooptical Climatology

(EOCLIMO, PC-0050); Cloud Ceiling Climatology (CCLIMO, PC-0060); Upper-Air Climatology (UACLIMO, PC-0055A); Modeled Ceiling/Visibility (MODCV, PC-0032); Modeled Diurnal/Annual Curves (MODCURVE); Nighttime Light Data (NITELITE, PC-0046A); Operational Climatic Data Summaries (OCDS) for selected locations in the Equatorial Africa theater; and a hypertext version of USAFETAC/TN-94/005, *Equatorial Africa: A Climatological Study*. User is guided among the various products via a graphic user interface. Requires Microsoft Windows Version 3.1; a Pentium processor is recommended.

CD-0011 TIPS Oct 97 (ver 1.0) This compact disk is a compilation of weather programs/help files developed by AFWA Technical Training Branch and the Air Force Combat Climatology Center. The intent was to provide a "single-source" of information for Air Force Weather units to use for training, or in tactical environments, to conserve hard drive. TIPS is a computerized help file consisting of hypertext links and jumps identified by "hot words." It guides forecasters through the "forecast process" and provides a wealth of reference material for just about any forecast objective. The "forecast process" consists of shift change, metwatch, analysis, and forecast development. MetTIPs is a consolidation of many forecaster aids, including rules of thumb, checklists, conversion charts, and reference tables. This CD is NOT, nor was it intended to be all inclusive, as AFCCC has many other programs available to you. Please note the following problems that you will encounter on the CD: **Important!** This CD can be run on systems with Windows version 3.1 or Windows 95/98. If you have any questions about this program, please contact HQ AFWA/DNTT at DSN 576-4721.

CD-0012 ExPERT OCT 97 (ver 1.0) Developed jointly by AF Research Laboratory, 88th Weather Squadron and AF Combat Climatology Center. ExPERT uses a detailed database for worldwide characterization of ALL land areas, ocean surfaces and atmospheres up to 80,000 feet. It contains data for nine different climatic regimes, six upper-air regions, six ocean regions and 289 individual sites worldwide. In addition, the text and tables of Military Standard 210C are included.

CD-0013 Theater Climatic File-Volume 4—South America (South of the Amazon River) June 98. Provides the user a variety of AFCCC climatological products on compact disk, tailored specifically for South America. Products include the following: Electrooptical

Climatology (EOCLIMO, PC-0050); Cloud Ceiling Climatology (CCLIMO, PC-0060); Upper-Air Climatology (UACLIMO, PC-0055A); Modeled Ceiling/Visibility (MODCV, PC-0032); Modeled Diurnal/Annual Curves (MODCURVE); Nighttime Light Data (NITELITE, PC-0046A); Operational Climatic Data Summaries (OCDS) for selected locations in Equatorial Africa theater; and a hypertext version of USAFETAC/TN-92/004 *South America South of the Amazon River, A Climatological Study*. User is guided among the various products via a graphic user interface. Requires Microsoft Windows Version 3.1; a Pentium processor is recommended.

CD-0014 Theater Climatic File, Volume 5—The Caribbean Basin (Central America to the West Indies to South America north of the Amazon River) May 99 (ver 1.0)— Provides the user a variety of AFCCC climatological products on compact disk, tailored specifically for Caribbean Basin. Products include the following: Electrooptical Climatology (EOCLIMO, PC-0050); Cloud Ceiling Climatology (CCLIMO, PC-0060); Upper-Air Climatology (UACLIMO, PC-0055A); Modeled Ceiling/Visibility (MODCV, PC-0032); Modeled Diurnal/Annual Curves (MODCURVE); Nighttime Light Data (NITELITE, PC-0046A); Operational Climatic Data Summaries (OCDS) for selected locations in Equatorial Africa theater; and a hypertext version of USAFETAC/TN-89/003, *The Caribbean Basin, A Climatological Study*. User is guided among the various products via a graphic user interface. Requires Microsoft Windows Version 3.1; a Pentium processor is recommended.

CD-0015 Upper Air Gridded Climatology, Version 1.0, produced by FNMOC, August 1995. The UAGC data set describes the atmosphere for each month of the year represented on a 2.5 degree global grid at 15 standard pressure levels. Mean and standard deviation values were compiled for sea level pressure, wind speed, air temperature, dew point, height, and density. The source of the UAGC data set was the European Center for Medium Range Weather Forecasting (ECMWF) 0000Z and 1200Z gridded analyses archived at the National Climatic Data Center (NCDC). The UAGC data set was derived from analyses for the period 1980-91. Resolution The spatial resolution of the UAGC data set is a 73 x 144 spherical grid spaced at 2.5 degrees, providing a resolution of about 100 km in the middle latitudes. The temporal resolution is 1 month. Organization The UAGC data set contains a mean and standard deviation of each of seven elements and an eight-point wind rose stratified for each month of the year for each of 10,512 grid points

at each of 15 levels. Any questions relating to the UAGC data set can be directed to: Officer in Charge, FLENUMMETOC DET, 151 Patton Avenue, Asheville, NC 28801-5014, Commercial: (704) 252-7865, 271-4232, or 271-4852, Fax: (704) 271-4672

CD-0016 Theater Climatic File, Volume 6—The Near East Mountains (Southwest Asia/Northeast Africa-(SWANEA) Vol. III), February 2000. The SWANEA III Theater Climatic File consolidates current information on the climatology of the portion of SWANEA (Southwest Asia/Northeast Africa) located in the Near East Mountains onto one compact disk (CD). The objective is to give the weather professional one source of information that is highly portable and provides rapid access to that data and to avoid maintaining or deploying with several bulky "hard copies" of climate data. The SWANEA III Theater Climatic File combines climatological data from AFCCC (formerly USAFETAC) technical studies which have been placed in a "hypertext" help file format, as well as existing AFCCC (USAFETAC) climatological applications software and Air Force Weather Agency (formerly Air Weather Service) weather applications. Requires Microsoft Windows 95 or higher and 100 MHz Pentium processor.

CD-0017: Theater Climatic File Volume 7—Southern Africa, March 2000. The Southern Africa Theater Climatic File consolidates current information on the climatology of Southern Africa onto one compact disk (CD). The objective is to give the weather professional one source of information that is highly portable and provides rapid access to that data, and to avoid maintaining or deploying with several bulky "hard copies" of climate data. The Southern Africa Theater Climatic File combines climatological data from AFCCC (formerly USAFETAC) technical studies which have been placed in a "hypertext" help file format, as well as existing AFCCC (USAFETAC) climatological applications software and Air Force Weather Agency weather applications. Requires Microsoft Windows 95 or higher and 100 MHz Pentium processor.

CD-0018 NightVision Goggles Operations Weather Software(NOWS), produced by AFRL (frequent updates to this program). NOWS is designed to assist Air Force/DoD meteorologists supporting forces performing operations using Night Vision Goggles (NVGs). Mission planners and pilots need to know if it is possible to conduct missions under low light level conditions using NVGs. The NVG Operations Weather Software (NOWS) package provides NVG performance

predictions for a specified mission and forecast local weather conditions. These performance predictions can be used by mission planners to make "go/no-go" decisions, to modify mission execution tactics, or to evaluate the general suitability of environmental conditions for NVGs. The performance predictions can be used by pilots to prepare for the expected conditions during a mission or training exercise. The types of missions supported by Nows include helicopter refueling, target acquisition/detection, take-off and landing, identification of pickup/drop zones, and search and rescue. A single mission may include several of these tasks. Nows is designed to provide several types of analyses: **Illumination Analysis:** Involves the computation of solar and lunar ephemeris information for a specified location. A mission planner, for example, might be interested in an illumination analysis to determine the time of sunset for a particular mission date and location. **Single Point-Based Analysis:** Involves detailed NVG performance predictions for a particular location. A mission planner, for example, might be interested in a point-based analysis to predict detection range for a particularly important target as a function of time. **Multiple map-Based:** Involves detailed NVG performance predictions for locations along a mission route. A mission planner, for example, might be interested in a map-based analysis to predict detection range for a series of key locations as a function of time. Nows runs on a PC under Microsoft Windows 95/NT/98. Nows Version 5 has a look-and-feel similar to standard Microsoft products, to minimize the time required to learn how to use Nows and to make performance of basic tasks, such as printing, saving, copying, and editing, easier. **Limited Distribution:** *Distribution limited to US Government Agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with Dod5230.25 Critical Technology. This is a NOFORN Document. Request this program through MAJCOM point of contact.*

CD-0019 Target Acquisition Weather Systems (TAWS), produced by AFRL (frequent updates to this program). The Target Acquisition Weather Software (TAWS) predicts the performance of air-to-ground electro-optical weapon and navigation systems. Performance is expressed primarily in terms of maximum detection or lock-on range. Results are displayed in graphic and tabular formats. TAWS supports systems in three regions of the spectrum: Infrared (3-5 microns; 8-12 microns); Visible (0.4 - 0.9 microns); and Laser (1.06 microns). The Visible includes both television (TV) and Night Vision Goggles (NVG) systems. TAWS is designed to provide several types of analyses: **Illumination Analysis:** Involves the computation of solar and lunar ephemeris information for a specified location. A mission

planner, for example, might be interested in an illumination analysis to determine the time of sunset for a particular mission date and location. **Single Point-Based Analysis:** Involves detailed performance predictions for a particular location. A mission planner, for example, might be interested in a point-based analysis to predict detection range for a particularly important target as a function of time. **Multiple Map-Based Analysis:** Involves detailed performance predictions for locations along a mission route. A mission planner, for example, might be interested in a map-based analysis to predict detection range for a series of key locations as a function of time. **Distribution limited to US Government Agencies and private individuals or enterprises eligible to obtain export-controlled technical data in accordance with Dod5230.25 Critical Technology. This is a NOFORN Document. Request this program through MAJCOM point of contact.**

CD-0020. Interactive Space Weather Training and Requirements Module, January 2000, 614 Space Operations Group. In addition to terrestrial weather, space weather plays a key role in the warfighters' ability to plan and conduct operations. To aid in the training and requirements process, we have developed this *Interactive Space Weather and Requirements Module*. This interactive module provides a wealth of information organized to facilitate quick reference to pertinent data. Topics addressed include: General background information, A worksheet to help you and your customer establish operational space weather requirements; Education and training documents and briefings on space environments and how it impacts military operations and additional information on the SIPERNET, NIPERNET and other resources.

CD-0021 Theater Climatic File Volume 8—East Asia Vol II: Maritime, March 2000. The Maritime East Asia Theater Climatic File consolidates current information on the climatology of the maritime portion of East Asia, including eastern China, Taiwan, and the Korean Peninsula, onto one compact disk (CD). The objective is to give the weather professional one source of information that is highly portable and provides rapid access to that data, and to avoid maintaining or deploying with several bulky "hard copies" of climate data. The Maritime East Asia Theater Climatic File combines climatological data from AFCCC (formerly USAFETAC) technical studies which have been placed in a "hypertext" help file format, as well as existing AFCCC climatological applications software and Air Force Weather Agency weather applications. Requires Microsoft Windows 95 or higher and 100 MHz Pentium processor.

Catalog of Air Force Weather Technical Documents

Chapter 8

1WW SPECIAL STUDIES

Request documents from the Air Force Weather Technical Library, 151 Patton Ave. Room 120, Asheville NC 28801-5002, DSN 673-9019.

1WW SS 105-1 (AD-235309) *Far East Climatology of the Jet Stream*, September 1955, 111pp.

1WW SS 105-2/1-12 (AD-None) *Monthly Climate of Korea*, 1968 (revised December 1976). Separate document (1-12) for each month.

1WW SS 105-3/B (AD-819674) *Climatic Data Summary for Southeast Asia*.

1WW SS 105-4 (AD469409) *Climate of North Vietnam*, June 1965, 92pp.

1WW SS 105-5 (AD469410) *Climate of Malaysia*, October 1964, 68pp.

1WW SS 105-6 (AD-409249) *Climatic Atlas of Indochina*, December 1964, 265pp.

1WW SS 105-7 (AD-469411) *Far East Climatic Atlas*, January 1965, 243pp.

1WW SS 105-8 (AD-704599) *Climatology of the Western Pacific*, March 1970, 74pp.

1WW SS 105-9 (AD-689786) *Climate of Republic of Vietnam*, March 1969, 138pp.

1WW SS 105-9/1-12 (AD-None) *Climate of Republic of Vietnam* (one document for each month), prepared from November 1969 to October 1970, 12-15pp per document.

1WW SS 105-10 (AD-470686) *Climate of Thailand*, August 1965, 127pp.

1WW SS 105-11/1-12 (AD-700785) *Climate of Southeast Asia* (one document for each month), prepared from December 1969 through October 1970, 59-70pp per document.

1WW SS 105-12/1 (AD-707496) *Ceiling and Visibility Atlas for Southeast Asia (1,000/2)*, May 1970, 104pp.

1WW SS 105-12/2 (AD-707494) *Ceiling and Visibility Atlas for Southeast Asia (5,000/5)*, May 1970, 104pp.

1WW SS 105-12/3 (AD-489616) *Sky Cover/Visibility Atlas for Southeast Asia (3/10 & 2 1/2)*, August 1966, 55pp.

1WW SS 105-12/4 (AD-806745) *Sky Cover/Visibility Atlas for Southeast Asia ($\leq 3/10$ below 10,000 feet & 5 mi)*, January 1967, 55pp.

1WW SS 105-13/1 (AD-48X117) *Medium-Level Persistency Analysis for Southeast Asia (5,000/5)*, July 1966, 144pp.

1WW SS 105-13/2 (AD-650903) *Low-Level Persistency Analysis for Southeast Asia (2,000/3)*, March 1967, 144pp.

1WW SS 105-14 (AD-697791) *Climate of Laos*, October 1969, 232pp.

1WW SS 105-15 (AD-670553) *Climate of Cambodia*, May 1968, 62pp.

1WW SS 105-55 (AD-A055750) *Occurrence of Typhoons/Typhoons (1949-1969) at Selected Locations*, April 1970 (updated through 1977, June 1978), 55pp. No longer available from 1st WW (superseded by 1WW/FM-89/001, Tropical Cyclone Climatology, Western Pacific).

1WW SS 105-60 (AD-None) *Climatology for Asian and Pacific Visits*, April 1969, 128pp.

Catalog of Air Force Weather Technical Documents

Chapter 9

MISCELLANEOUS WEATHER INFORMATION SOURCES

This section contains information on the most frequently requested materials that are not maintained by the AFWTL and is provided to help AFWTL customers locate the materials.

1. Cooperative Program for Operational Meteorology, Education and Training (COMET) Materials. The following location is the point-of-contact for these materials:

HQ AFWA/DNTT
ATTN: Mr Stan Zlochen
106 Peacekeeper Drive Ste 2N3
Offutt AFB NE 68113-4039
DSN: 271-9646 Com: (402) 294-9646
e-mail: Stanley.Zlochen@afwa.af.mil

2. Audiovisual Materials. The following location maintains copies of Follow-on Training (FOT) and other weather-related audiovisual materials:

USACIV/JVIA
ATTN SAM-OPV-JT-AS
BLDG 3/BAY 3
11 HAP ARNOLD BLVD
TOBYHANNA PA 18466-5102
DSN: 795-7104/7192
FAX: 795-6106

3. Miscellaneous Technical Documents. Sources for other frequently requested documents are listed below:

- **607 Weather Squadron Publications**
<http://607ws.korea.army.mil/>
- **USAFE Operational Weather Squadron**
<http://ows.sembach.af.mil/>

• **U.S. Marine Corps Handbooks**

OH-0-53 *A Foot In The Desert*
OH-0-54 *The Persian Gulf, A Climatological Study*
OH-0-55 *Desert Water Supply*
OH-0-57 *A study of Wind-borne Sand and Dust in the Desert Areas*
OH-0-58 *Problems in Desert Warfare*
OH-0-59 *The Environment and It's Effect on Material, Personnel and Operations with Special Emphasis on the Middle East*

• **EO-TDA PHILLIPS LABORATORY Limited to DoD and DoD Contractors only**

PL-TR-94-2174(1) *ELECTRO-OPTICAL TACTICAL DECISION AID (EOTDA) USER'S MANUAL VERSION 3.1* (Scientific Report No. 52, Volume I) (U)

PL-TR-94-2174(2) *ELECTRO-OPTICAL TACTICAL DECISION AID (EOTDA) USER'S MANUAL VERSION 3.1* (Scientific Report No. 52, Volume II) (U)

- **Joint Meteorology and Oceanography (METOC) Training Handbook.** AFWTL does not distribute this document. Call the point-of-contact at DSN 836-7851, COM (757) 836-7851 or send an email to J332WX@hq.acom.mil to request the required number of copies (CD format).